

# Chapter 1

## Channelized QPP Interfaces

In JUNOS software release 5.6 and later, Juniper Networks adds support for channelized interfaces enhanced with the Q Performance Processor (QPP) ASIC. Channelized QPP interfaces provide a more flexible way to configure channels than earlier channelized Physical Interface Cards (PICs) and a simplified configuration structure self-contained in the [edit interfaces] hierarchy level. Channelized QPP interfaces also enable class of service at the PIC level rather than the Flexible PIC Concentrator (FPC) level.

This guide highlights the features of the new channelized PICs with QPP and their similarities to and differences from the original channelized interfaces.

This feature guide covers these topics:

Overview on page 2

System Requirements on page 6

Terms and Acronyms on page 6

Configure Channelized QPP Interfaces on page 7

Example: Clear Channel Configuration for a Channelized OC-12 QPP Interface on page 11

Check Your Work on page 11

Example: Complex Configuration for a Channelized OC-12 QPP Interface on page 14

Check Your Work on page 21

Example: Channelized E1 QPP Interface Configuration on page 36

Check Your Work on page 37

Example: Channelized DS-3 QPP Interface Configuration on page 41

Check Your Work on page 42

Example: Channelized STM-1 QPP Interface Configuration on page 47

Check Your Work on page 50

Configure Class of Service for Channelized QPP Interfaces on page 54

Example: DLCI Class of Service on Channelized QPP Interfaces Configuration on page 55

Check Your Work on page 57

For More Information on page 57

Revision History on page 57

## Overview

Channelized interfaces allow service providers to customize bandwidth to satisfy the needs of their customers. Whether the subscriber needs DS-0, T1, fractional T1, E1, fractional E1, T3, STM-1, OC-3, or OC-12 service, a channelized PIC can provide the necessary bandwidth today and can be reconfigured to support the customer's expanding network tomorrow. Standard channelized interfaces have been available on Juniper Networks platforms since JUNOS software release 3.4. These original channelized PICs for Juniper Networks M-series routers are available in the following models:

One-port Channelized OC-12

Ten-port Channelized E1

One-port Channelized STM-1

Four-port Channelized DS-3

One-port and two-port multichannel Channelized DS-3

These original channelized interfaces provide a single level of channelization and require configuration at both the [edit chassis] and the [edit interfaces] hierarchy levels. Most configuration options must be set on channel 0 and they apply to all channels on these channelized PICs.

The new channelized PICs with QPP offer several advantages over the original channelized PICs:

Complete configuration tasks for channelized QPP interfaces are now centralized at the [edit interfaces] hierarchy level.

Multiple levels of channelization are now possible with channelized QPP interfaces. For example, a channelized OC-12 QPP interface can be divided into channelized OC-1 interfaces, then subdivided into channelized T1 interfaces, and further split into  $N \times$  DS-0 channels.

You can now configure interface statements, such as clocking, on individual channels rather than configuring them on channel 0 for all channels at the same hierarchy level.

Class-of-service processing now occurs on the PIC for channelized QPP interfaces rather than in the FPC.

Channelized PICs with QPP come in the following model types:

One-port Channelized OC-12 PIC with QPP

Four-port Channelized DS-3 PIC with QPP

Ten-port Channelized E1 PIC with QPP

One-port Channelized STM-1 PIC with QPP

To determine which type of channelized PIC is installed in your router, use the show chassis hardware command:

```

user@RouterA> show chassis hardware
Hardware inventory:
Item                Version  Part number  Serial number  Description
Chassis              20070      M160
Midplane             REV 03    710-001245   AB4123
FPM CMB              REV 02    710-001642   AB3266
FPM Display          REV 02    710-001647   AB3038
CIP                  REV 04    710-001593   AB3276
PEM 0                Rev 03    740-001243   KM28410        DC
PEM 1                Rev 03    740-001243   LF21558        Power Entry Module
PCG 0                REV 03    710-001568   AB3006
PCG 1                REV 02    710-001568   AB2992
Routing Engine 0    20000005dfae3a01 RE-2.0
MCS 0               REV 04    710-001226   AB3208
MCS 1               REV 04    710-001226   AB3212
SFM 0 SPP           REV 06    710-001228   AB3103
SFM 0 SPR           REV 01    710-002189   AB2936        Internet Processor II
SFM 1 SPP           REV 07    710-001228   AG2634
SFM 1 SPR           REV 03    710-002189   AE3503        Internet Processor II
SFM 2 SPP           REV 06    710-001228   AB2976
SFM 2 SPR           REV 01    710-002189   AB2938        Internet Processor II
SFM 3 SPP           REV 06    710-001228   AB5826
SFM 3 SPR           REV 01    710-002189   AB2917        Internet Processor II
FPC 0               REV 03    710-003947   HE0614        E-FPC Type 1
  CPU               REV 01    710-004600   AT3217
  PIC 0             REV 03    750-005636   BE1826        4x CHDS3 QPP
# This is the channelized DS-3 QPP PIC.
  PIC 1             REV 07    750-003846   HG5572        1x 800M Crypto
  PIC 2             REV 01    750-004507   BA5341        10x CE1-NxDS0
  PIC 3             REV 06    750-003009   AM6929        4x CT3
#This is the original channelized T3 PIC.
FPC 1               REV 03    710-003309   AD9434        E-FPC Type 2
  CPU               REV 05    710-001217   AH2707
  PIC 2             REV 05    750-001900   AD5738        1x OC-48 SONET, SMSR
  PIC 3             REV 04    750-003737   BC1106        4x G/E, 1000 BASE-SX

```

Table 2 shows you how many channels and which interface types you can configure on channelized QPP interfaces:

**Table 2: Number and Types of Channels Configurable on Channelized QPP Interfaces**

Interface	1-port Channelized OC-12 QPP PIC	4-port Channelized DS-3 QPP PIC	10-port Channelized E1 QPP PIC	1-port Channelized STM-1 QPP PIC
OC-12c	1	n/a	n/a	n/a
OC-3c	4	n/a	n/a	n/a
STM-1	n/a	n/a	n/a	1
T3	12	4 (1 per port)	n/a	n/a
T1 / Fractional T1	336	112 (28 per port)	n/a	n/a
E1 / Fractional E1	n/a	n/a	10 (1 per port)	63
NxDS-0	336	128	128—If the “N” in NxDS-0 is 8 or less. 256—If the “N” in NxDS-0 is 9 or more.	310
<b>Maximum per PIC</b>	336	256	310	128

When you configure channelized QPP interfaces, keep in mind these rules of thumb:

You normally configure media-related statements and options at the physical interface level (also known as the controller level). This level is indicated by the [edit interfaces *cxx-fpc/pic/port*] hierarchy level.

You should always configure HDLC-related statements (for example, bytes, fcs, idle-cycle-flag, mtu, receive-bucket, start-end-flag, and transmit-bucket) and logical interfaces (for example, [edit interfaces *interface-name* unit *unit-number*]) on end channels such as DS-0 and T1. Never configure these statements at the controller level.

Pay attention to the channel numbering rules:

OC-3 SONET channels configured on channelized OC-12 QPP interfaces are numbered from 1 to 4.

T3 channels configured on channelized OC-12 QPP interfaces are numbered from 1 to 12.

T1 channels configured on either a channelized OC-12 QPP interface or a channelized DS-3 QPP interface are numbered from 1 to 28.

E1 channels configured on a channelized STM-1 QPP interface are numbered from 1 to 63.

NxDS-0 timeslots configured on either a channelized OC-12 QPP interface or a channelized DS-3 QPP interface are numbered from 1 to 24.

NxDS-0 timeslots configured on either a channelized STM-1 QPP interface or channelized E1 QPP interface are numbered from 1 to 31. (Timeslot 0 is reserved.)

You can configure automatic protection switching (APS) on channelized OC-12 QPP and multiplex section protection (MSP) on channelized STM-1 QPP interfaces. These protection methods are used by SONET/SDH add/drop multiplexers (ADMs) to protect against circuit failures. The JUNOS implementation of APS allows you to protect against circuit failures between an ADM and one or more routers, and between multiple interfaces in the same router. When a device fails, a backup immediately takes over.

You can configure APS at the controller level only. To configure the working and backup circuits, include the `working-circuit` and `protect-circuit` statements at the `[edit interfaces coc12-fpc/pic/port sonet-options aps]` or `[edit interfaces cstm1-fpc/pic/port sonet-options aps]` hierarchy level.

When you enable the controller-level interface as the working circuit, all partitions under the working circuit are also enabled. Note that this is the default behavior even when APS is not configured. When the backup circuit interface is disabled, all partitions under this protected circuit are also disabled. When the working circuit fails, the interfaces are switched: The working circuit and all its partitions are disabled, and the protect circuit and all its partitions are enabled. You can verify this behavior by entering the `show interface controller` command. The disabled interfaces are shown as “Admin down” and the enabled interfaces are shown as “Admin up.”

If you use Frame Relay encapsulation on a channelized interface, see Table 3 for the number of data-link connection identifiers (DLCIs) that you can configure at each channel level. Note that you can configure a maximum of 383 DLCIs per channelized QPP PIC.

**Table 3: Frame Relay DLCI Limitations for Channelized Interfaces**

Original Channelized PICs	Number of DLCIs per level	Range
T3 and T1 level channels	64 for regular mode 3 for sparse mode	0—64 for regular mode 1—1022 for sparse mode (0 is reserved for the Local Management Interface or LMI)
DS-0 level channels	3 for sparse mode	1—1022 for sparse mode (0 is reserved for LMI)
Channelized PICs with QPP	Number of DLCIs per level	Range
OC-12 and OC-3 level channels (Channelized OC-12 PIC with QPP)	64	1—1022 (0 is reserved for LMI)
T3 level channel (Channelized DS-3 or Channelized OC-12 PICs with QPP)	64	1—1022 (0 is reserved for LMI)
STM-1 level channel (Channelized STM-1 PIC with QPP)	64	1—1022 (0 is reserved for LMI)
E1 level channels (Channelized STM-1 or E1 PICs with QPP)	16	1—1022 (0 is reserved for LMI)
T1 level channels (Channelized DS-3 or Channelized OC-12 PICs with QPP)	16	1—1022 (0 is reserved for LMI)
DS-0 level channels (Channelized DS-3, Channelized STM-1, Channelized E1, or Channelized OC-12 PICs with QPP)	16	1—1022 (0 is reserved for LMI)

When you configure clocking, bit error rate testing (BERT), C-bit parity, and loopback statements on T3, T1, or DS-0 channels on channelized QPP interfaces, you must follow these guidelines:

If you include the statements at both the [edit interfaces ct3-fpc/pic/port:channel t3-options] and [edit interfaces t3-fpc/pic/port:channel t3-options] hierarchy levels, the channelized T3-level statements are operational and the T3-level statements are ignored.

If you include the statements at both the [edit interfaces ct3-fpc/pic/port:channel t3-options] and [edit interfaces t1-fpc/pic/port:channel t1-options] hierarchy levels, the channelized T3-level statements are operational for the T3 connections and the T1-level statements are operational for the T1 connections.

Because DS-0 channels do not have a valid clocking option, you must configure clocking for all NxDS-0s at the [edit interfaces ct1-fpc/pic/port:channel t1-options] hierarchy level.

You can configure BERT at the [edit interfaces ct3-fpc/pic/port:channel t3-options] hierarchy level or on any partitioned subchannel of the channelized T3 interface. There are twelve BERT patterns available for DS-0 channels and twenty-eight BERT patterns for T1, channelized T1, T3, and channelized T3 channels within channelized QPP interfaces.

You can configure loopbacks at the [edit interfaces ct3-fpc/pic/port:channel t3-options] hierarchy level and higher. Local loopbacks recirculate framing information within the local router. Remote loopbacks resend entire frames back to the remote sender. A new loopback called a *payload loopback* is similar to a remote loopback, but it resends only the data portion of a frame back to the remote sender.

You can configure C-bit parity at the [edit interfaces ct3-fpc/pic/port:channel t3-options] hierarchy level or on any partitioned subchannel of the channelized T3 interface.

For more details on channelized interface options, see the *JUNOS Internet Software Configuration Guide: Network Interfaces and Class of Service*.

## System Requirements

To implement channelized QPP interfaces, your system must meet these requirements:

JUNOS Release 5.6 or later for channelized DS-3, E1, and OC-12 QPP interfaces

JUNOS Release 5.7 or later for channelized STM-1 QPP interfaces

JUNOS Release 5.7 or later for logical interface-level class of service on the channelized DS-3, E1, and OC-12 QPP interfaces

JUNOS Release 6.0 or later for logical interface-level class of service on channelized STM-1 QPP interfaces, and APS/MSP on OC-12 QPP and STM-1 QPP interfaces

Two Juniper Networks M-series routers equipped with an Enhanced Type 1 or Type 2 Flexible PIC Concentrator (FPC)

## Terms and Acronyms

**Q Performance Processor (QPP) ASIC**—A next-generation processor that provides enhanced capabilities for channelized interfaces.

## Configure Channelized QPP Interfaces

To enable channelized QPP interfaces, you can configure the following:

Configure a Clear Channel on a Channelized QPP Interface on page 7

Configure Single-Level Channels on a Channelized QPP Interface on page 8

Configure Multilevel Channels on a Channelized QPP Interface on page 8

To apply your knowledge, visit these sections:

Example: Clear Channel Configuration for a Channelized OC-12 QPP Interface on page 11

Check Your Work on page 11

Example: Complex Configuration for a Channelized OC-12 QPP Interface on page 14

Check Your Work on page 21

Example: Channelized E1 QPP Interface Configuration on page 36

Check Your Work on page 37

Example: Channelized DS-3 QPP Interface Configuration on page 41

Check Your Work on page 42

Example: Channelized STM-1 QPP Interface Configuration on page 47

Check Your Work on page 50

### **Configure a Clear Channel on a Channelized QPP Interface**

A clear channel consolidates the entire bandwidth of a channelized interface into a single unpartitioned stream, making the interface look like a standard unchannelized interface. For example, an OC-12 channelized interface configured as a clear channel appears to have an OC-12 SONET interface. To configure a clear channel on a channelized QPP interface, include the `no-partition` statement at the `[edit interfaces cxx-fpc/pic/port]` hierarchy level. Once the interface has been established, you can configure it the same way as a regular interface.

```
[edit]
interfaces {
  coc12-1/1/0 {
    no-partition;           # This creates a SONET OC-12 interface:
  so-1/1/0.
  }
  so-1/1/0 {
    unit 0 {
      family inet {
        address 10.245.1.1/30;
      }
    }
  }
}
```

## Configure Single-Level Channels on a Channelized QPP Interface

You can subdivide a channelized interface into end channels. To configure part of a channelized QPP interface as an end channel, include the partition statement at the [edit interfaces *cxx-fpc/pic/port*] hierarchy level. On a channelized OC-12 QPP interface, use the *oc-slice* option to create slice sizes corresponding to the desired bandwidth. On a channelized E1 QPP interface, use the *timeslots* option to define *N*xDS-0 channels or channel groups. On all channelized QPP interfaces, use the *interface-type* option to set the interface type (such as SONET OC-3 or T3). Once the end channel interfaces have been established, you can configure them the same way as regular interfaces.



**Note**

One *oc-slice* in a channelized OC-12 QPP interface partition is equivalent to one OC-1/DS-3 sized channel. If you add three slices together in sequence as a triplet, these pieces become an OC-3-sized interface. However, you can configure triplets only with the following sequential slices: 1 - 3, 4 - 6, 7 - 9, 10 - 12.

```
[edit]
interfaces {
  coc12-0/0/0 {
    partition 1 oc-slice 1-3 interface-type so; # Creates an OC-3 SONET interface:
    }                                     # so-0/0/0:1
  so-0/0/0:1 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.2/30;
      }
    }
  }
}
```

## Configure Multilevel Channels on a Channelized QPP Interface

You can subdivide a channelized interface and then split these subchannelized interfaces into end channels. Creating end channels might require multiple levels of channelization.

To configure a subdivided channelized interface within a partition of a channelized QPP interface, include the partition statement at the [edit interfaces *cxx-fpc/pic/port*] hierarchy level. On a channelized OC-12 QPP interface, use the *oc-slice* option to create slice sizes corresponding to the desired bandwidth. On all channelized QPP interfaces, use the *interface-type* option to set the channelized interface type (such as channelized OC-1).

On a channelized OC-12 QPP interface, you can convert a subdivided channelized OC-1 interface into a T3 or channelized T3 interface. To configure, include the *no-partition* statement at the [edit interfaces *coc1-fpc/pic/port:channel*] hierarchy level and set the *interface-type* to *ct3*. A *ct3-fpc/pic/port:channel* interface is the result. Such a conversion is known as M13 with C-bit parity mapping. T1 and DS-0 channels created directly from a *coc-1* interface use VT mapping.

To further split your channelized interfaces into even smaller channelized interfaces, use the *partition* and *interface-type* statements at the [edit interfaces *cxx-fpc/pic/port:channel*] hierarchy level. You can create channelized OC-1, channelized T3, and channelized T1 interfaces, depending on the PIC type.

Finally, you configure these “channels of channels” as end channels. To configure end channels on a segmented channelized QPP interface, include the partition statement at the [edit interfaces *cxx-fpc/pic/port:channel*] hierarchy level. The number of channels in the hierarchy depends on how finely you partition the channelized QPP interface. Use the timeslots option to select *NxDS-0* level channels and the interface-type option to set the interface type (such as T1 or *NxDS-0*). Once the resulting channels have been established, you can configure them as regular interfaces.

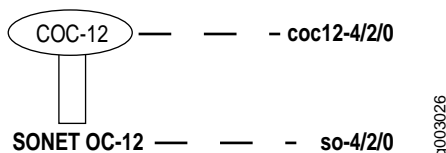
```
[edit]
interfaces {
  coc12-0/0/0 {
    partition 2 oc-slice 4 interface-type coc1; #Creates channelized OC-1 interfaces:
    partition 3 oc-slice 5 interface-type coc1; # coc1-0/0/0:2, :3, and :4
    partition 4 oc-slice 6 interface-type coc1;
  }
  coc1-0/0/0:2 {
    no-partition interface-type t3; #Converts a channelized OC-1 to a T3 interface:
  }
  t3-0/0/0:2 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.6/30;
      }
    }
  }
  coc1-0/0/0:3 {
    no-partition interface-type ct3; # Creates a channelized T3 interface: ct3-0/0/0:3
  }
  ct3-0/0/0:3 {
    partition 1-28 interface-type t1; # Creates 28 T1 interfaces: t1-0/0/0:3:1 - 28
  }
  coc1-0/0/0:4 {
    partition 1 interface-type ct1; # Creates a channelized T1 interface: t1-0/0/0:4:1
  }
  ct1-0/0/0:4:1 {
    partition 1 timeslots 1 interface-type ds; # Creates 1xDS-0 interface: ds-0/0/0:4:1:1
    ...
    partition 24 timeslots 24 interface-type ds; # Creates 1xDS-0 interface:
  }
  t1-0/0/0:3:1 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.26/30;
      }
    }
  }
  ...
}
ds-0/0/0:4:1:24 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.214/30;
    }
  }
}
}
```

A useful operational command you can use with all channelized QPP interfaces is the `show interfaces interval` command. It shows a summary of alarms, status indicators, and performance monitoring statistics in 15 minute increments over the past 24 hours. More detail on each of these indicators can be seen with the `show interfaces extensive` command:

```
user@router> show interfaces interval cstml-0/0/0
Physical interface: cstml-0/0/0, SNMP ifIndex: 32
17:23-current:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
17:08-17:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
16:53-17:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
16:38-16:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
16:23-16:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
16:08-16:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
15:53-16:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
15:38-15:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
15:23-15:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
15:08-15:23:
  RS-ES: 33, RS-SES: 33, RS-SEFS: 32, MS-ES: 32, MS-SES: 32, MS-UAS: 4
14:53-15:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
14:38-14:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
14:23-14:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
14:08-14:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
13:53-14:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
13:38-13:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
13:23-13:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
13:08-13:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
12:53-13:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
12:38-12:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
12:23-12:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
12:08-12:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
11:53-12:08:
  RS-ES: 11, RS-SES: 11, RS-SEFS: 11, MS-ES: 11, MS-SES: 11, MS-UAS: 1
Interval Total:
  RS-ES: 44, RS-SES: 44, RS-SEFS: 43, MS-ES: 43, MS-SES: 43, MS-UAS: 5
```

### Example: Clear Channel Configuration for a Channelized OC-12 QPP Interface

Figure 1: OC-12 Clear Channel on a Channelized OC-12 QPP Interface



The key to this simple example is to remove all partitions from the channelized interface. To configure a clear channel on a channelized QPP interface, include the no-partition statement at the [edit interfaces coc12-fpc/pic/0] hierarchy level. After you commit this part of the configuration, the clear channel is set and you can configure the resulting SONET interface normally.

```
Router A [edit]
interfaces {
  coc12-4/2/0 {
    no-partition;
  }
  so-4/2/0 {
    unit 0 {
      family inet {
        address 10.245.1.1/30;
      }
    }
  }
}
```

### Check Your Work

To verify correct operation of a channelized QPP interface configured as a clear channel, use the following commands:

```
show interfaces
show interfaces controller
```

To view the interface names of the physical channelized OC-12 QPP interface and the clear channel OC-12 interface configured on the channelized QPP interface, use the show interfaces controller command:

```
user@RouterA> show interfaces controller
Controller
coc12-4/2/0                               Admin Link
                                           up      up

# This is the physical channelized OC-12 QPP interface.

so-4/2/0                                   up      up

# This is the resulting SONET OC-12 interface.
```

To view information about the physical channelized interface, include the *cxx-fpc/pic/0* (interface name) option with the show interfaces command:

```

user@RouterA> show interfaces extensive coc12-4/2/0
Physical interface: coc12-4/2/0, Enabled, Physical link is Up
  Interface index: 74, SNMP ifIndex: 1269, Generation: 73
  Link-level type: Controller, MTU: 4474, Clocking: Internal, SONET mode, Speed:
OC12, Loopback: None,
  FCS: 16, Payload scrambler: Disabled, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  Last flapped  : 2002-10-09 10:56:45 PDT (05:14:39 ago)
  Statistics last cleared: Never
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops:
0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link
CRC errors: 0,
    HS link FIFO overflows: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO
underflows: 0
  SONET alarms   : None
  SONET defects  : None
  SONET PHY:
    Seconds      Count  State
    PLL Lock     0      0 OK
    PHY Light    0      0 OK
  SONET section:
    BIP-B1       10     55
    SEF          0      0 OK
    LOS          0      0 OK
    LOF          0      0 OK
    ES-S         10
    SES-S        0
    SEFS-S       0
  SONET line:
    BIP-B2       10     144
    REI-L        0      0
    RDI-L        3      1 OK
    AIS-L        0      0 OK
    BERR-SF     0      0 OK
    BERR-SD     1      1 OK
    ES-L        10
    SES-L        0
    UAS-L        0
    ES-LFE      3
    SES-LFE     3
    UAS-LFE     0
  Received SONET overhead:
    F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
    S1      : 0x00
  Transmitted SONET overhead:
    F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
    S1      : 0x00

```

To view information about the clear channel SONET interface, include the `so-fpc/pic/0` (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces extensive so-4/2/0
Physical interface: so-4/2/0, Enabled, Physical link is Up
  Interface index: 261, SNMP ifIndex: 2000, Generation: 260
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode,
Speed: OC12, Loopback: None, FCS: 16,
  Payload scrambler: Enabled, Parent: coc12-4/2/0 (Index 74)
Device flags      : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags       : Keepalives
Hold-times       : Up 0 ms, Down 0 ms
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive statistics:
  Input  : 37 (last seen 00:00:04 ago)
  Output: 36 (last sent 00:00:09 ago)
LCP state: Opened
NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls:
Not-configured
CHAP state: Not-configured
Last flapped   : 2002-10-09 16:04:18 PDT (00:07:26 ago)
Statistics last cleared: Never
Traffic statistics:
  Input bytes   :           80461791           7435000 bps
  Output bytes  :           81637408           7502352 bps
  Input packets :           34017           275 pps
  Output packets:           34298           278 pps
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0,
Bucket drops: 0, Policed discards: 0,
  L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link
CRC errors: 0,
  HS link FIFO overflows: 0
Output errors:
  Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO
underflows: 0
Queue counters:      Queued packets  Transmitted packets      Dropped packets
  0 best-effort      34129                34129                    0
  1 expedited-fo      0                    0                        0
  2 assured-forw      0                    0                        0
  3 network-cont      0                    0                        0
SONET alarms       : None
SONET defects      : None
SONET path:
  BIP-B3            0                    0
  REI-P             0                    0
  LOP-P             0                    0 OK
  AIS-P             0                    0 OK
  RDI-P             0                    0 OK
  UNEQ-P            0                    0 OK
  PLM-P             0                    0 OK
  ES-P              0
  SES-P             0
  UAS-P             0
  ES-PFE            0
  SES-PFE           0
  UAS-PFE           0
Received SONET overhead:
  C2      : 0xcf, C2(cmp) : 0xcf, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00, S1(cmp) : 0x00

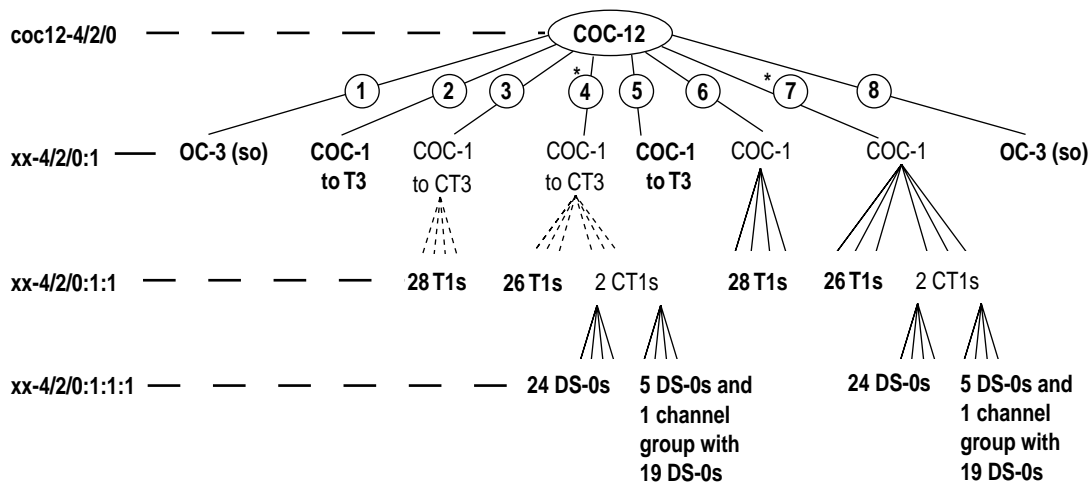
```

```

Transmitted SONET overhead:
  C2      : 0xcf, F2      : 0x00, Z3      : 0x00, Z4      : 0x00
Received path trace: RouterB so-2/2/0
  61 72 6d 61 67 6e 61 63 20 73 6f 2d 32 2f 32 2f  RouterB so-2/2/
  30 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  0.....
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a  .....
Transmitted path trace: RouterA so-4/2/0
  74 69 6d 6d 65 73 73 71 75 61 72 65 20 73 6f 2d  RouterA so-
  34 2f 32 2f 30 00 00 00 00 00 00 00 00 00 00 00  4/2/0.....
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 0, Runt threshold: 0
Packet Forwarding Engine configuration:
  Destination slot: 4, PLP byte: 4 (0x00)
  CoS transmit queue      Bandwidth      Buffer Priority  Limit
                           bps
  0 best-effort           95 590976000 95 0 low none
  3 network-control       5 31104000 5 0 low none
Logical interface so-4/2/0.0 (Index 7) (SNMP ifIndex 2001) (Generation 12)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Protocol inet, MTU: 4470, Generation: 18, Route table: 0
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.245.1.0/30, Local: 10.245.1.1, Broadcast: Unspecified,
  Generation: 21
    
```

### Example: Complex Configuration for a Channelized OC-12 QPP Interface

Figure 2: Complex Configuration for a Channelized OC-12 QPP Interface



\* NxDS-0 mapping methods  
 4 = M13 with C-bit parity  
 7 = VT mapping

9003027

Table 4: Complex Channelization for a Channelized OC-12 QPP Interface

Partition	Slices	Interface Type	Interface Level 2	Interface Level 3
1	1 - 3	OC-3	n/a	n/a
2	4	Channelized OC-1 converted to T3	n/a	n/a
3	5	Channelized OC-1 converted to Channelized T3	28 T1s	n/a
4	6	Channelized OC-1 converted to Channelized T3	26 T1s	n/a
-	-	-	2 CT1s	24 DS-0s
-	-	-	-	5 DS-0s and 1 channel group of 19 DS-0s
5	7	Channelized OC-1 converted to T3	n/a	n/a
6	8	Channelized OC-1	28 T1s	n/a
7	9	Channelized OC-1	26 T1s	n/a
-	-	-	2 CT1s	24 DS-0s
-	-	-	-	5 DS-0s and 1 channel group of 19 DS-0s
8	10 - 12	OC-3	n/a	n/a

Figure 2 on page 14 and Table 4 show a complex channelization structure that you might encounter if you use the full capabilities of a channelized OC-12 QPP interface. Partitions 1 and 8 create an OC-3 interface, while Partitions 2 and 5 create T3 interfaces out of channelized OC-1 interfaces. Partition 3 (channelized OC-1 converted to channelized T3) and Partition 6 (channelized OC-1) are channelized interfaces that each subdivide into 28 T1 interfaces. Finally, Partition 4 (channelized OC-1 converted to channelized T3) and Partition 7 (channelized OC-1) are channelized interfaces that each split into 2 channelized T1 interfaces and 26 T1 interfaces. The first channelized T1 splits into 24 DS-0 timeslots, while the second channelized T1 subdivides into 5 DS-0 channels and 1 channel group comprised of 19 DS-0 channels.

This example shows two NxDS-0 mapping methods. Partition 4 uses M13 mapping for North American T-carrier equipment and Partition 7 uses VT mapping for SONET/SDH equipment.

This example also assumes corresponding interfaces. For example, for every sublevel T1 interface you configure on Router A, assume you have configured a matching sublevel or physical T1 interface on a neighboring router.

```

Router A [edit]
interfaces {
  coc12-4/2/0 {
    partition 1 oc-slice 1-3 interface-type so; # Creates an OC-3 SONET interface: so-4/2/0:1
    partition 2 oc-slice 4 interface-type coc1; # Creates the interface coc1-4/2/0:2
    partition 3 oc-slice 5 interface-type coc1; # Creates the interface: coc1-4/2/0:3
    partition 4 oc-slice 6 interface-type coc1; # Creates the interface: coc1-4/2/0:4
    partition 5 oc-slice 7 interface-type coc1; # Creates the interface: coc1-4/2/0:5
    partition 6 oc-slice 8 interface-type coc1; # Creates the interface: coc1-4/2/0:6
    partition 7 oc-slice 9 interface-type coc1; # Creates the interface: coc1-4/2/0:7
    partition 8 oc-slice 10-12 interface-type so; # Creates an OC-3 SONET interface: so-4/2/0:8
  }
  so-4/2/0:1 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.2/30;
      }
    }
  }
  coc1-4/2/0:2 {
    no-partition interface-type t3; # This converts the coc1 interface into a T3 interface:
    }                                     # t3-4/2/0:2.
  t3-4/2/0:2 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.6/30;
      }
    }
  }
  coc1-4/2/0:3 {
    no-partition interface-type ct3; # This converts the coc1 interface into a
    }                                     # channelized T3 interface: ct3-4/2/0:3.
  ct3-4/2/0:3 {
    partition 1-28 interface-type t1; # This converts the channelized T3 interface into
    }                                     # 28 T1 channels: t1-4/2/0:3:1 through t1-4/2/0:3:28.
  coc1-4/2/0:4 {
    no-partition interface-type ct3; # This converts the coc1 interface into a
    }                                     # channelized T3 interface: ct3-4/2/0:4.
  ct3-4/2/0:4 {
    partition 1-2 interface-type ct1; # This creates ct1-4/2/0:4:1 and ct1-4/2/0:4:2.
    partition 3-28 interface-type t1; # This creates t1-4/2/0:4:3 through t1-4/2/0:4:28.
  }
  coc1-4/2/0:5 {
    no-partition interface-type t3; # This converts the coc1 interface to a T3: t3-4/2/0:5.
  }
  t3-4/2/0:5 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.1.90/30;
      }
    }
  }
  coc1-4/2/0:6 {
    partition 1-28 interface-type t1; # This converts the channelized OC-1 interface into
    }                                     # 28 T1s: t1-4/2/0:6:1 through t1-4/2/0:6:28.
  }
}

```

```

coc1-4/2/0:7 {
  partition 1-2 interface-type ct1;    #This creates ct1-4/2/0:7:1 and ct1-4/2/0:7:2.
  partition 3-28 interface-type t1;    #This creates t1-4/2/0:7:3 through t1-4/2/0:7:28.
}
so-4/2/0:8 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.174/30;
    }
  }
}
t1-4/2/0:3:1 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.10/30;
    }
  }
}
...
t1-4/2/0:3:28 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.118/30;
    }
  }
}
ct1-4/2/0:4:1 {
  partition 1 timeslots 1 interface-type ds;    #This creates 24 DS-0 channels:
  partition 2 timeslots 2 interface-type ds;    # ds-4/2/0:4:1:1 through ds-4/2/0:4:1:24.
  partition 3 timeslots 3 interface-type ds;
  partition 4 timeslots 4 interface-type ds;
  partition 5 timeslots 5 interface-type ds;
  partition 6 timeslots 6 interface-type ds;
  partition 7 timeslots 7 interface-type ds;
  partition 8 timeslots 8 interface-type ds;
  partition 9 timeslots 9 interface-type ds;
  partition 10 timeslots 10 interface-type ds;
  partition 11 timeslots 11 interface-type ds;
  partition 12 timeslots 12 interface-type ds;
  partition 13 timeslots 13 interface-type ds;
  partition 14 timeslots 14 interface-type ds;
  partition 15 timeslots 15 interface-type ds;
  partition 16 timeslots 16 interface-type ds;
  partition 17 timeslots 17 interface-type ds;
  partition 18 timeslots 18 interface-type ds;
  partition 19 timeslots 19 interface-type ds;
  partition 20 timeslots 20 interface-type ds;
  partition 21 timeslots 21 interface-type ds;
  partition 22 timeslots 22 interface-type ds;
  partition 23 timeslots 23 interface-type ds;
  partition 24 timeslots 24 interface-type ds;
}

```

```

ds-4/2/0:4:1:1 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.122/30;
    }
  }
}
...
ds-4/2/0:4:1:24 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.214/30;
    }
  }
}
ct1-4/2/0:4:2 {
  partition 1 timeslots 1-19 interface-type ds;# ds-4/2/0:4:2:1 is a channel group.
  partition 2 timeslots 20 interface-type ds;# ds-4/2/0:4:2:2 through ds-4/2/0:4:2:6 are
  partition 3 timeslots 21 interface-type ds;# single 64 kbps NxDS-0 channels.
  partition 4 timeslots 22 interface-type ds;
  partition 5 timeslots 23 interface-type ds;
  partition 6 timeslots 24 interface-type ds;
}
ds-4/2/0:4:2:1 {          # This NxDS-0 is a channel group with 19 DS-0s bundled as one.
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.218/30;
    }
  }
}
ds-4/2/0:4:2:2 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.120.0.222/30;
    }
  }
}
...
ds-4/2/0:4:2:6 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.120.0.238/30;
    }
  }
}
t1-4/2/0:4:3 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.120.0.242/30;
    }
  }
}
...

```

```

t1-4/2/0:4:28 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.1.86/30;
    }
  }
}
t1-4/2/0:6:1 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.1.94/30;
    }
  }
}
...
t1-4/2/0:6:28 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.1.202/30;
    }
  }
}
ct1-4/2/0:7:1 {
  partition 1 timeslots 1 interface-type ds;
  partition 2 timeslots 2 interface-type ds;
  partition 3 timeslots 3 interface-type ds;
  partition 4 timeslots 4 interface-type ds;
  partition 5 timeslots 5 interface-type ds;
  partition 6 timeslots 6 interface-type ds;
  partition 7 timeslots 7 interface-type ds;
  partition 8 timeslots 8 interface-type ds;
  partition 9 timeslots 9 interface-type ds;
  partition 10 timeslots 10 interface-type ds;
  partition 11 timeslots 11 interface-type ds;
  partition 12 timeslots 12 interface-type ds;
  partition 13 timeslots 13 interface-type ds;
  partition 14 timeslots 14 interface-type ds;
  partition 15 timeslots 15 interface-type ds;
  partition 16 timeslots 16 interface-type ds;
  partition 17 timeslots 17 interface-type ds;
  partition 18 timeslots 18 interface-type ds;
  partition 19 timeslots 19 interface-type ds;
  partition 20 timeslots 20 interface-type ds;
  partition 21 timeslots 21 interface-type ds;
  partition 22 timeslots 22 interface-type ds;
  partition 23 timeslots 23 interface-type ds;
  partition 24 timeslots 24 interface-type ds;
}
ds-4/2/0:7:1:1 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.1.206/30;
    }
  }
}
...

```

#This creates 24 DS-0 channels:  
# ds-4/2/0:7:1:1 through ds-4/2/0:7:1:24.

```

ds-4/2/0:7:1:24 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.42/30;
    }
  }
}
ct1-4/2/0:7:2 {
  partition 1 timeslots 1-19 interface-type ds;# ds-4/2/0:7:2:1 is a channel group.
  partition 2 timeslots 20 interface-type ds;# ds-4/2/0:7:2:2 through ds-4/2/0:7:2:6 are
  partition 3 timeslots 21 interface-type ds;# single 64 kbps NxDS-0 channels.
  partition 4 timeslots 22 interface-type ds;
  partition 5 timeslots 23 interface-type ds;
  partition 6 timeslots 24 interface-type ds;
}
ds-4/2/0:7:2:1 {          # This NxDS-0 is a channel group with 19 DS-0s bundled as one.
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.46/30;
    }
  }
}
ds-4/2/0:7:2:2 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.50/30;
    }
  }
}
...
ds-4/2/0:7:2:6 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.66/30;
    }
  }
}
t1-4/2/0:7:3 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.70/30;
    }
  }
}
...
t1-4/2/0:7:28 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.170/30;
    }
  }
}
}
}

```





```

coc1-4/2/0:6
  t1-4/2/0:6:1
  t1-4/2/0:6:2
  t1-4/2/0:6:3
  t1-4/2/0:6:4
  t1-4/2/0:6:5
  t1-4/2/0:6:6
  t1-4/2/0:6:7
  t1-4/2/0:6:8
  t1-4/2/0:6:9
  t1-4/2/0:6:10
  t1-4/2/0:6:11
  t1-4/2/0:6:12
  t1-4/2/0:6:13
  t1-4/2/0:6:14
  t1-4/2/0:6:15
  t1-4/2/0:6:16
  t1-4/2/0:6:17
  t1-4/2/0:6:18
  t1-4/2/0:6:19
  t1-4/2/0:6:20
  t1-4/2/0:6:21
  t1-4/2/0:6:22
  t1-4/2/0:6:23
  t1-4/2/0:6:24
  t1-4/2/0:6:25
  t1-4/2/0:6:26
  t1-4/2/0:6:27
  t1-4/2/0:6:28
coc1-4/2/0:7
  ct1-4/2/0:7:1
    ds-4/2/0:7:1:1
    ds-4/2/0:7:1:2
    ds-4/2/0:7:1:3
    ds-4/2/0:7:1:4
    ds-4/2/0:7:1:5
    ds-4/2/0:7:1:6
    ds-4/2/0:7:1:7
    ds-4/2/0:7:1:8
    ds-4/2/0:7:1:9
    ds-4/2/0:7:1:10
    ds-4/2/0:7:1:11
    ds-4/2/0:7:1:12
    ds-4/2/0:7:1:13
    ds-4/2/0:7:1:14
    ds-4/2/0:7:1:15
    ds-4/2/0:7:1:16
    ds-4/2/0:7:1:17
    ds-4/2/0:7:1:18
    ds-4/2/0:7:1:19
    ds-4/2/0:7:1:20
    ds-4/2/0:7:1:21
    ds-4/2/0:7:1:22
    ds-4/2/0:7:1:23
    ds-4/2/0:7:1:24
  ct1-4/2/0:7:2
    ds-4/2/0:7:2:1
    ds-4/2/0:7:2:2
    ds-4/2/0:7:2:3
    ds-4/2/0:7:2:4
    ds-4/2/0:7:2:5
    ds-4/2/0:7:2:6

```

```

t1-4/2/0:7:3          up    up
t1-4/2/0:7:4          up    up
t1-4/2/0:7:5          up    up
t1-4/2/0:7:6          up    up
t1-4/2/0:7:7          up    up
t1-4/2/0:7:8          up    up
t1-4/2/0:7:9          up    up
t1-4/2/0:7:10         up    up
t1-4/2/0:7:11         up    up
t1-4/2/0:7:12         up    up
t1-4/2/0:7:13         up    up
t1-4/2/0:7:14         up    up
t1-4/2/0:7:15         up    up
t1-4/2/0:7:16         up    up
t1-4/2/0:7:17         up    up
t1-4/2/0:7:18         up    up
t1-4/2/0:7:19         up    up
t1-4/2/0:7:20         up    up
t1-4/2/0:7:21         up    up
t1-4/2/0:7:22         up    up
t1-4/2/0:7:23         up    up
t1-4/2/0:7:24         up    up
t1-4/2/0:7:25         up    up
t1-4/2/0:7:26         up    up
t1-4/2/0:7:27         up    up
t1-4/2/0:7:28         up    up
so-4/2/0:8            up    up

```

To verify that your channelized QPP interfaces are working as expected, use the `show interfaces` command. Use the `show interfaces controller` command to find the name of the channelized interface you want to view; then include this channelized name (for example, `ct3-4/2/0:4`) as an option with the `show interfaces` command.

The next section provides one sample `show interfaces` output for each of the major interface types configured in this example:

```

Channelized OC-12 user@RouterA> show interfaces extensive coc12-4/2/0
Physical interface: coc12-4/2/0, Enabled, Physical link is Up
  Interface index: 266, SNMP ifIndex: 1269, Generation: 601
  Link-level type: Controller, MTU: 4474, Clocking: Internal, SONET mode, Speed:
OC12, Loopback: None,
  FCS: 16, Payload scrambler: Disabled, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Hold-times     : Up 0 ms, Down 0 ms
  Last flapped   : 2002-10-09 17:45:15 PDT (00:14:38 ago)
  Statistics last cleared: Never
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops:
0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link
CRC errors: 0,
    HS link FIFO overflows: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO
underflows: 0
  SONET alarms   : None
  SONET defects  : None

```

```

SONET PHY:                Seconds      Count  State
  PLL Lock                 0          0  OK
  PHY Light                0          0  OK
SONET section:
  BIP-B1                  14          83
  SEF                     0          0  OK
  LOS                     0          0  OK
  LOF                     0          0  OK
  ES-S                    14
  SES-S                   0
  SEFS-S                  0
SONET line:
  BIP-B2                  14          162
  REI-L                   0          0
  RDI-L                   3          1  OK
  AIS-L                   0          0  OK
  BERR-SF                 0          0  OK
  BERR-SD                 0          0  OK
  ES-L                    14
  SES-L                   0
  UAS-L                   0
  ES-LFE                  3
  SES-LFE                 3
  UAS-LFE                 0
Received SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00

```

```

SONET OC-3 user@RouterA> show interfaces extensive so-4/2/0:8
Physical interface: so-4/2/0:8, Enabled, Physical link is Up
Interface index: 440, SNMP ifIndex: 2640, Generation: 787
Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC3,
Loopback: None, FCS: 16,
Payload scrambler: Enabled, Parent: coc12-4/2/0 (Index 266)
Device flags      : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags       : Keepalives
Hold-times       : Up 0 ms, Down 0 ms
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive statistics:
  Input : 0 (last seen: never)
  Output: 0 (last sent: never)
LCP state: Conf-ack-sent
NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mpls:
Not-configured
CHAP state: Not-configured
Last flapped   : 2002-10-09 17:45:18 PDT (00:11:45 ago)
Statistics last cleared: Never
Traffic statistics:
  Input bytes   :                5967                56 bps
  Output bytes  :                12672               128 bps
  Input packets:                 351                  0 pps
  Output packets:                 704                  0 pps
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops:
0, Policed discards: 0,
  L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link

```

```

CRC errors: 0,
  HS link FIFO overflows: 0
Output errors:
  Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO
underflows: 0
Queue counters:      Queued packets  Transmitted packets      Dropped packets
  0 best-effort      704                0                        0
  1 expedited-fo      0                  0                        0
  2 assured-forw      0                  0                        0
  3 network-cont      0                  0                        0
SONET alarms   : None
SONET defects  : None
SONET path:
  BIP-B3        0                0
  REI-P         0
  LOP-P         0                0 OK
  AIS-P         0                0 OK
  RDI-P         0                0 OK
  UNEQ-P        0                0 OK
  PLM-P         0                0 OK
  ES-P          0
  SES-P         0
  UAS-P         0
  ES-PFE        0
  SES-PFE       0
  UAS-PFE       0
Received SONET overhead:
  C2      : 0xcf, C2(cmp) : 0xcf, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  C2      : 0xcf, F2      : 0x00, Z3      : 0x00, Z4      : 0x00
Received path trace: RouterB so-2/2/0:8
  61 72 6d 61 67 6e 61 63 20 73 6f 2d 32 2f 32 2f RouterB so-2/2/
  30 3a 38 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a
Transmitted path trace: RouterA so-4/2/0:8
  74 69 6d 6d 65 73 73 71 75 61 72 65 20 73 6f 2d RouterA so-
  34 2f 32 2f 30 3a 38 00 00 00 00 00 00 00 00 00 00 00 00 00
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 0, Runt threshold: 0
Packet Forwarding Engine configuration:
  Destination slot: 4, PLP byte: 4 (0x2a)
  CoS transmit queue      Bandwidth      Buffer Priority  Limit
                           %      bps      %      bytes
  0 best-effort            95      147744000 95      0      low  none
  3 network-control        5       7776000  5       0      low  none

Logical interface so-4/2/0:8.0 (Index 180) (SNMP ifIndex 2641) (Generation
512)
  Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
  Protocol inet, MTU: 4470, Generation: 519, Route table: 0
  Flags: Protocol-Down
  Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
    Destination: 10.255.2.172/30, Local: 10.255.2.174, Broadcast:
Unspecified, Generation: 1029

```

```

T3 user@RouterA> show interfaces extensive t3-4/2/0:2
Physical interface: t3-4/2/0:2, Enabled, Physical link is Up
Interface index: 274, SNMP ifIndex: 1982, Generation: 609
Link-level type: PPP, MTU: 4474, Clocking: Internal, Speed: T3, Loopback:None,
FCS: 16,
Mode: C/Bit parity, Parent: coc12-4/2/0 (Index 266)
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : Keepalives
Hold-times     : Up 0 ms, Down 0 ms
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive statistics:
  Input : 85 (last seen 00:00:00 ago)
  Output: 82 (last sent 00:00:01 ago)
LCP state: Opened
NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls:
Not-configured
CHAP state: Not-configured
Last flapped   : 2002-10-09 17:45:15 PDT (00:13:24 ago)
Statistics last cleared: Never
Traffic statistics:
  Input bytes   :           2546           56 bps
  Output bytes  :           2732           56 bps
  Input packets:           170           0 pps
  Output packets:          171           0 pps
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Bucket drops: 0, Policed discards:
0, L3 incompletes: 0,
  L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM
errors: 0
Output errors:
  Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0
Queue counters:      Queued packets  Transmitted packets  Dropped packets
0 best-effort         171                171                0
1 expedited-fo         0                   0                  0
2 assured-forw         0                   0                  0
3 network-cont         0                   0                  0
Active alarms   : None
Active defects  : None
DS3 media:      Seconds          Count  State
  PLL Lock      0                0  OK
  Reframing     0                0  OK
  AIS           0                0  OK
  LOF           0                0  OK
  LOS           0                0  OK
  IDLE          0                0  OK
  YELLOW        0                0  OK
  BPV           0                0
  EXZ           0                0
  LCV           0                0
  PCV           1                6827
  CCV           0                0
  LES           0
  PES           1
  PSES          1
  CES           0
  CSES          0
  SEFS          0
  UAS           0
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 4484, Runt threshold: 0

```

```

DSU configuration:
  Compatibility mode: None, Scrambling: Disabled, Subrate: Disabled
  FEAC loopback: Inactive, Response: Disabled, Count: 0
DS-3 BERT configuration:
  BERT time period: 10 seconds, Elapsed: 0 seconds
  Algorithm: 2^3 - 1, Pseudorandom (1), Induced error rate: 10e-0
SONET alarms      : None
SONET defects     : None
SONET path:
  BIP-B3          0          0
  REI-P           0          0
  LOP-P           0          0 OK
  AIS-P           0          0 OK
  RDI-P           0          0 OK
  UNEQ-P          0          0 OK
  PLM-P           0          0 OK
  ES-P            0
  SES-P           0
  UAS-P           0
  ES-PFE          0
  SES-PFE         0
  UAS-PFE         0
Received SONET overhead:
  C2      : 0x04, C2(cmp) : 0x04, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  C2      : 0x04, F2      : 0x00, Z3      : 0x00, Z4      : 0x00
Received path trace:
  5d 14 d6 ef 81 93 78 71 98 ec 55 27 35 84 3a 2c ]Vo..xq.lU'5.:
Transmitted path trace: t3-4/2/0:2
  74 33 2d 34 2f 32 2f 30 3a 32 00 00 00 00 00 00 t3-4/2/0:2.....
Packet Forwarding Engine configuration:
  Destination slot: 4, PLP byte: 4 (0x00)
  CoS transmit queue      Bandwidth      Buffer Priority Limit
                           %      bps      %      bytes
  0 best-effort           95      42499200 95      0      low  none
  3 network-control       5       2236800  5       0      low  none

Logical interface t3-4/2/0:2.0 (Index 10) (SNMP ifIndex 1983) (Generation 340)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 4470, Generation: 347, Route table: 0
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
  Destination: 10.255.0.4/30, Local: 10.255.0.6, Broadcast: Unspecified,
  Generation: 685

```

```

Channelized T3 user@RouterA> show interfaces extensive ct3-4/2/0:4
Physical interface: ct3-4/2/0:4, Enabled, Physical link is Up
  Interface index: 304, SNMP ifIndex: 2409, Generation: 639
  Link-level type: Controller, MTU: 4474, Clocking: Internal, Speed: T3,
  Loopback: None, FCS: 16,
  Mode: C/Bit parity, Parent: coc12-4/2/0 (Index 266)
  Device flags      : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags        : None
  Hold-times        : Up 0 ms, Down 0 ms
  Last flapped      : 2002-10-09 17:45:16 PDT (00:12:56 ago)
  Statistics last cleared: Never

```

```

Traffic statistics:
Input bytes : 0 0 bps
Output bytes : 0 0 bps
Input packets: 0 0 pps
Output packets: 0 0 pps
Input errors:
Errors: 0, Drops: 0, Framing errors: 0, Bucket drops: 0, Policed discards:
0, L3 incompletes: 0,
L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM
errors: 0
Output errors:
Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
Active alarms : None
Active defects : None
DS3 media:
Seconds Count State
PLL Lock 0 0 OK
Reframing 0 0 OK
AIS 0 0 OK
LOF 0 0 OK
LOS 0 0 OK
IDLE 0 0 OK
YELLOW 0 0 OK
BPV 0 0
EXZ 0 0
LCV 0 0
PCV 1 1
CCV 1 1
LES 0
PES 1
PSES 0
CES 1
CSES 0
SEFS 0
UAS 0
HDLC configuration:
Policing bucket: Disabled
Shaping bucket : Disabled
Giant threshold: 0, Runt threshold: 0
DSU configuration:
Compatibility mode: None, Scrambling: Disabled, Subrate: Disabled
FEAC loopback: Inactive, Response: Disabled, Count: 0
DS-3 BERT configuration:
BERT time period: 10 seconds, Elapsed: 0 seconds
Algorithm: 2^3 - 1, Pseudorandom (1), Induced error rate: 10e-0
SONET alarms : None
SONET defects : None
SONET PHY:
Seconds Count State
PLL Lock 0 0 OK
PHY Light 0 0 OK
SONET section:
BIP-B1 14 83
SEF 0 0 OK
LOS 0 0 OK
LOF 0 0 OK
ES-S 14
SES-S 0
SEFS-S 0

```

```

SONET line:
  BIP-B2          14          162
  REI-L           0           0
  RDI-L           3           1 OK
  AIS-L           0           0 OK
  BERR-SF         0           0 OK
  BERR-SD         0           0 OK
  ES-L            14
  SES-L           0
  UAS-L           0
  ES-LFE          3
  SES-LFE         3
  UAS-LFE         0
SONET path:
  BIP-B3          0           0
  REI-P           0           0
  LOP-P           0           0 OK
  AIS-P           0           0 OK
  RDI-P           0           0 OK
  UNEQ-P          0           0 OK
  PLM-P           0           0 OK
  ES-P            0
  SES-P           0
  UAS-P           0
  ES-PFE          0
  SES-PFE         0
  UAS-PFE         0
Received SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x04, C2(cmp) : 0x04, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x04, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00
Received path trace:
  39 b8 27 50 44 b6 5f c3 f3 de 27 9a a0 31 40 5c 98'PD6_Cs^'. 1@\
Transmitted path trace: RouterA ct3-4/2/0:4
  74 69 6d 6d 65 73 73 71 75 61 72 65 20 63 74 33 RouterA ct3
Packet Forwarding Engine configuration:
Destination slot: 0 (0x00)
CoS transmit queue          Bandwidth          Buffer Priority  Limit
                             %          bps          %          bytes
0 best-effort                95          42499200 95          0          low  none
3 network-control            5           2236800  5           0          low  none

```

```

Channelized OC-1 user@RouterA> show interfaces extensive coc1-4/2/0:7
Physical interface: coc1-4/2/0:7, Enabled, Physical link is Up
Interface index: 381, SNMP ifIndex: 2524, Generation: 728
Link-level type: Controller, MTU: 4474, Clocking: Internal, SONET mode, Speed:
51840kbps, Loopback: None,
FCS: 16, Payload scrambler: Disabled, Parent: coc12-4/2/0 (Index 266)
Device flags : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags : None
Hold-times : Up 0 ms, Down 0 ms
Last flapped : 2002-10-09 17:45:31 PDT (00:12:11 ago)
Statistics last cleared: Never

```

```

Traffic statistics:
Input bytes : 0 0 bps
Output bytes : 0 0 bps
Input packets: 0 0 pps
Output packets: 0 0 pps
Input errors:
Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops:
0, Policed discards: 0,
L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link
CRC errors: 0,
HS link FIFO overflows: 0
Output errors:
Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO
underflows: 0
SONET alarms : None
SONET defects : None
SONET section:
BIP-B1 14 83
SEF 0 0 OK
LOS 0 0 OK
LOF 0 0 OK
ES-S 14
SES-S 0
SEFS-S 0
SONET line:
BIP-B2 14 162
REI-L 0 0
RDI-L 3 1 OK
AIS-L 0 0 OK
BERR-SF 0 0 OK
BERR-SD 0 0 OK
ES-L 14
SES-L 0
UAS-L 0
ES-LFE 3
SES-LFE 3
UAS-LFE 0
SONET path:
BIP-B3 0 0
REI-P 0 0
LOP-P 0 0 OK
AIS-P 0 0 OK
RDI-P 0 0 OK
UNEQ-P 3 1 OK
PLM-P 3 1 OK
ES-P 3
SES-P 3
UAS-P 0
ES-PFE 0
SES-PFE 0
UAS-PFE 0
Received SONET overhead:
F1 : 0x00, J0 : 0x00, K1 : 0x00, K2 : 0x00
S1 : 0x00, C2 : 0x00, C2(cmp) : 0x00, F2 : 0x00
Z3 : 0x00, Z4 : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
F1 : 0x00, J0 : 0x01, K1 : 0x00, K2 : 0x00
S1 : 0x00, C2 : 0x00, F2 : 0x00, Z3 : 0x00
Z4 : 0x00

```

```

Received path trace:
a0 6a b2 b6 97 aa 25 5e 54 e3 59 2a 80 84 dd fa      j26.*%^TcY*..]z
af ec 42 d3 21 45 5d 48 f4 5a dd e5 1c be e7 65      /LBS!E]HtZ]e.>ge
e7 f2 94 71 f1 d7 d7 86 98 83 d5 e2 ec 67 1d db      gr.qgWW...Ublg.[
5b 72 29 b3 b9 97 98 c9 c1 a3 af e2 ab db d0 be      [r)39...IA#/b+[P>

Transmitted path trace: RouterA coc1-4/2/0:7
74 69 6d 6d 65 73 73 71 75 61 72 65 20 63 6f 63      RouterA coc
31 2d 34 2f 32 2f 30 3a 37 00 00 00 00 00 00 00      1-4/2/0:7.....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....

HDLC configuration:
Policing bucket: Disabled
Shaping bucket : Disabled
Giant threshold: 0, Runt threshold: 0
Packet Forwarding Engine configuration:
Destination slot: 0 (0x00)
CoS transmit queue          Bandwidth          Buffer Priority  Limit
                             %          bps          %          bytes
0 best-effort                95          49248000 95          0          low  none
3 network-control            5           2592000  5           0          low  none

```

**Channelized T1**

```

user@RouterA> show interfaces extensive ct1-4/2/0:4:1
Physical interface: ct1-4/2/0:4:1, Enabled, Physical link is Up
  Interface index: 305, SNMP ifIndex: 2410, Generation: 640
  Link-level type: Controller, MTU: 1504, Clocking: Internal, Speed: T1,
Loopback: None, FCS: 16,
  Framing: ESF, Parent: ct3-4/2/0:4 (Index 304)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  Last flapped  : 2002-10-09 17:45:19 PDT (00:16:49 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :                0          0 bps
    Output bytes  :                0          0 bps
    Input packets :                0          0 pps
    Output packets:                0          0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
L3 incompletes:0, L2 channel errors: 0,
    L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM errors: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
  DS1 alarms   : None
  DS1 defects  : None

```

```

T1 media:                Seconds      Count  State
SEF                      1          1  OK
BEE                      1          1  OK
AIS                      0          0  OK
LOF                      1          1  OK
LOS                      0          0  OK
YELLOW                   0          0  OK
BPV                      0          0
EXZ                      0          0
LCV                      0          0
PCV                      0          0
CS                       0          0
LES                      1          1
ES                       1          1
SES                      2          2
SEFS                     2          2
BES                      0          0
UAS                      0          0

HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 0, Runt threshold: 0
  Timeslots      : All active
  Line encoding: B8ZS, Byte encoding: Nx64K
  Buildout       : 0 to 132 feet
  Data inversion: Disabled

DS1 BERT configuration:
  BERT time period: 10 seconds, Elapsed: 0 seconds
  Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)

Packet Forwarding Engine configuration:
  Destination slot: 0 (0x00)
  CoS transmit queue      Bandwidth      Buffer Priority  Limit
                           %          bps          %          bytes
  0 best-effort           95          1459200  95          0          low  none
  3 network-control       5           76800    5           0          low  none

```

```

T1 user@RouterA> show interfaces extensive t1-4/2/0:7:3
Physical interface: t1-4/2/0:7:3, Enabled, Physical link is Up
  Interface index: 414, SNMP ifIndex: 2587, Generation: 761
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: T1, Loopback:
None, FCS: 16, Framing: ESF,
  Parent: coc1-4/2/0:7 (Index 381)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times     : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 0 (last seen: never)
    Output: 0 (last sent: never)
  LCP state: Conf-ack-sent
  NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mpls:
Not-configured
  CHAP state: Not-configured
  Last flapped : 2002-10-09 17:45:34 PDT (00:10:33 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes :          10778          112 bps
    Output bytes :          11412          128 bps
    Input packets:           634           0 pps
    Output packets:          634           0 pps

```

```

Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
L3 incompletes: 0, L2 channel errors: 0,
  L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM errors: 0
Output errors:
  Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0
Queue counters:      Queued packets  Transmitted packets  Dropped packets
  0 best-effort      633                633                  0
  1 expedited-fo      0                  0                   0
  2 assured-forw      0                  0                   0
  3 network-cont      0                  0                   0
DS1  alarms   : None
DS1  defects  : None
T1  media:      Seconds          Count  State
  SEF           1                1     OK
  BEE           1                1     OK
  AIS           3                1     OK
  LOF          17                1     OK
  LOS           0                0     OK
  YELLOW        0                0     OK
  BPV           0                0
  EXZ           0                0
  LCV           0                0
  PCV           0                0
  CS            0                0
  LES           17               17
  ES            17               17
  SES           34               34
  SEFS          34               34
  BES           0
  UAS           14
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 1514, Runt threshold: 0
  Timeslots      : All active
  Line encoding: B8ZS, Byte encoding: Nx64K
  Buildout       : 0 to 132 feet
  Data inversion: Disabled
DS1 BERT configuration:
  BERT time period: 10 seconds, Elapsed: 0 seconds
  Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)
SONET alarms   : None
SONET defects  : None
SONET vt:
  BIP-BIP2      648                0
  REI-V         651                1
  LOP-V         0                0 OK
  AIS-V         0                0 OK
  RDI-V         651                1 Defect Active
  UNEQ-V        0                0 OK
  PLM-V         0                0 OK
  ES-V          651                651
  SES-V         3
  UAS-V         0
  ES-VFE        0
  SES-VFE       0
  UAS-VFE       0
Received SONET overhead:
  V5           : 0x02, V5(cmp) : 0x02
Transmitted SONET overhead:
  V5           : 0x02

```

```

Packet Forwarding Engine configuration:
Destination slot: 4, PLP byte: 4 (0x24)
CoS transmit queue          Bandwidth          Buffer Priority  Limit
                             %             bps             %             bytes
0 best-effort                95             1459200        95             0             low          none
3 network-control            5              76800          5              0             low          none

Logical interface tl-4/2/0:7:3.0 (Index 152) (SNMP ifIndex 2588)
(Generation 484)
Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
Bandwidth: 0
Protocol inet, MTU: 1500, Generation: 491, Route table: 0
Flags: Protocol-Down
Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
Destination: 10.255.2.68/30, Local: 10.255.2.70, Broadcast: Unspecified,
Generation: 973

```

```

DS-0 user@RouterA> show interfaces extensive ds-4/2/0:4:1:1
Physical interface: ds-4/2/0:4:1:1, Enabled, Physical link is Up
Interface index: 306, SNMP ifIndex: 2411, Generation: 641
Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 64kbps, Loopback:
None, FCS: 16,
Parent: ct1-4/2/0:4:1 (Index 305)
Device flags      : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags       : Keepalives
Hold-times       : Up 0 ms, Down 0 ms
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive statistics:
Input  : 98 (last seen 00:00:01 ago)
Output: 100 (last sent 00:00:00 ago)
LCP state: Opened
NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls:
Not-configured
CHAP state: Not-configured
Last flapped   : 2002-10-09 17:45:15 PDT (00:16:20 ago)
Statistics last cleared: Never
Traffic statistics:
Input bytes  :                3013                0 bps
Output bytes :                3228                0 bps
Input packets:                 201                0 pps
Output packets:                202                0 pps
Input errors:
Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
L3 incompletes: 0, L2 channel errors: 0,
L2 mismatch timeouts: 0, HS link CRC errors: 0
Output errors:
Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0
Queue counters:      Queued packets  Transmitted packets  Dropped packets
0 best-effort                202                202                0
1 expedited-fo              0                  0                  0
2 assured-forw              0                  0                  0
3 network-cont              0                  0                  0
Interface transmit queues:
          B/W  WRR      Packets      Bytes      Drops      Errors
Queue0    0    0          0          0          0          0
Queue1    0    0          0          0          0          0
HDLC configuration:
Giant threshold: 0, Runt threshold: 0
Timeslots      : 1
Byte encoding: Nx64K, Data inversion: Disabled
Idle cycle flag: flags, Start end flag: shared

```

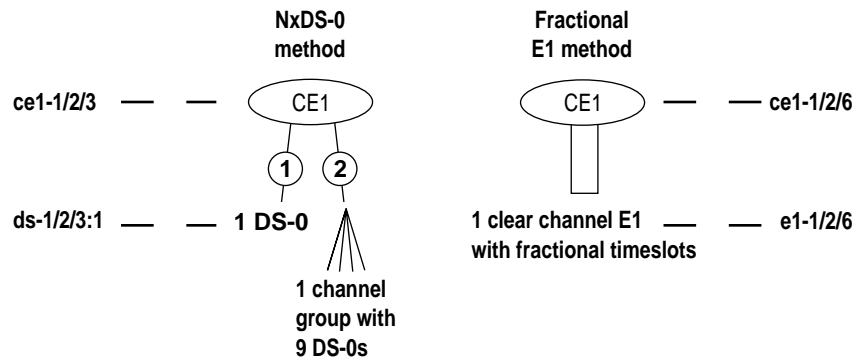
```

Packet Forwarding Engine configuration:
Destination slot: 4, PLP byte: 4 (0x07)
CoS transmit queue          Bandwidth          Buffer Priority  Limit
                             %             bps             %             bytes
0 best-effort                95             60800          95             0             low          none
3 network-control            5              3200           5              0             low          none

Logical interface ds-4/2/0:4:1:1.0 (Index 39) (SNMP ifIndex 2412)
(Generation 369)
Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
Bandwidth: 0
Protocol inet, MTU: 1500, Generation: 376, Route table: 0
Flags: None
Addresses, Flags: Is-Preferred Is-Primary
Destination: 10.255.0.120/30, Local: 10.255.0.122, Broadcast:
Unspecified, Generation: 743
    
```

### Example: Channelized E1 QPP Interface Configuration

Figure 3: Channelized E1 QPP Interface Example



The next example shows two ways to configure a channelized E1 QPP interface. Figure 3 shows a fractional E1 method and the NxDS-0 method seen previously in the complex OC-12 configuration example (see “Example: Complex Configuration for a Channelized OC-12 QPP Interface” on page 14). The NxDS-0 method breaks the channelized E1 QPP interface into discrete DS-0 blocks, while the fractional method creates a clear channel E1 that is segmented by timeslots.

To configure the NxDS-0 method, include the partition statement at the [edit interfaces ce1-fpc/pic/port] hierarchy level. Include the timeslots and interface-type options to create the desired number of NxDS-0 interfaces.

To configure a fractional E1 on a channelized E1 QPP interface, include the no-partition statement at the [edit interfaces ce1-fpc/pic/port] hierarchy level. After you commit this part of the configuration, a clear channel E1 interface is established. You can configure standard E1 options on this interface. Also, include the timeslots statement at the [edit interfaces e1-fpc/pic/port e1-options] hierarchy level. However, timeslot 1 is reserved, so use 2 through 31.

6003029

```

Router A - NxDS-0 [edit]
method interfaces {
  ce1-1/2/3 {
    partition 1 timeslots 10 interface-type ds;#This creates the NxDS-0 channel: ds-1/2/3:1.
    partition 2 timeslots 1-9 interface-type ds;#This creates a channel group with 9 NxDS-0s:
    }                                     # ds-1/2/3:2.
  ds-1/2/3:1 {
    unit 0 {
      family inet {
        address 10.25.1.2/24;
      }
    }
  }
  ds-1/2/3:2 {
    unit 0 {
      family inet {
        address 10.25.2.2/24;
      }
    }
  }
}

```

```

Router A - Fractional E1 [edit]
method interfaces {
  ce1-1/2/6 {
    no-partition; # This creates a single E1 channel: e1-1/2/6.
  }
  e1-1/2/6 {
    e1-options { # This statement enables only 2 of the 31 NxDS-0 timeslots on e1-1/2/6.
      timeslots 2-3;
    }
    unit 0 {
      family inet {
        address 10.255.126.2/24;
      }
    }
  }
}

```

## Check Your Work

To verify correct operation of a channelized E1 QPP interface, use the following commands:

```
show interfaces
```

```
show interfaces controller
```

```
show interfaces interval (for E1 and channelized E1 channels)
```

To view the interface names of the physical channelized E1 QPP interface and the resulting interfaces configured on the channelized QPP interface, use the `show interfaces controller` command:

```
user@RouterA> show interfaces controller ce1-1/2/3
Controller                               Admin Link
ce1-1/2/3                                up      up
```

# This is the physical channelized E1 QPP interface.

```
    ds-1/2/3:1                            up      up
    ds-1/2/3:2                            up      up
```

# These are the resulting `MXDS-0` interfaces.

```
user@RouterA> show interfaces controller ce1-1/2/6
Controller                               Admin Link
ce1-1/2/6                                up      up
```

# This is the physical channelized E1 QPP interface.

```
e1-1/2/6                                  up      up
```

# This is the resulting E1 interface.

To view information about the physical channelized interface, include the `ce1-fpc/pic/port` (interface name) option with the `show interfaces` command:

```
user@RouterA> show interfaces ce1-1/2/3
Physical interface: ce1-1/2/3, Enabled, Physical link is Up
  Interface index: 18, SNMP ifIndex: 1128
  Link-level type: Controller, MTU: 1504, Clocking: Internal, Speed: E1,
  Loopback: None, FCS: 16, Framing: G704, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped   : 2002-10-04 17:52:51 PDT (00:32:57 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  DS1 alarms    : None
  DS1 defects   : None
```

```
user@RouterA> show interfaces ce1-1/2/6
Physical interface: ce1-1/2/6, Enabled, Physical link is Up
  Interface index: 25, SNMP ifIndex: 1134
  Link-level type: Controller, MTU: 1504, Clocking: Internal, Speed: E1,
  Loopback: None,
  FCS: 16, Framing: G704, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped   : 2002-10-04 17:52:51 PDT (00:34:49 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  DS1 alarms    : None
  DS1 defects   : None
```

To view information about an *NxDS-0* interface, include the *ds-fpc/pic/port:channel* (interface name) option with the *show interfaces* command:

```
user@RouterA> show interfaces ds-1/2/3:1 detail
Physical interface: ds-1/2/3:1, Enabled, Physical link is Up
  Interface index: 73, SNMP ifIndex: 1202, Generation: 325
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 64kbps, Loopback:
None,
  FCS: 16, Parent: cel-1/2/3 (Index 18)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 11 (last seen 00:00:02 ago)
    Output: 10 (last sent 00:00:06 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Opened, iso: Opened, mpls: Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-04 18:24:32 PDT (00:01:46 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :           559           56 bps
    Output bytes  :           656           56 bps
    Input packets :            33            0 pps
    Output packets:            36            0 pps
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
    0 best-effort   40                    40                0
    1 expedited-fo  0                     0                 0
    2 assured-forw  0                     0                 0
    3 network-cont  0                     0                 0

Logical interface ds-1/2/3:1.0 (Index 36) (SNMP ifIndex 1266) (Generation 153)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Protocol inet, MTU: 1500, Generation: 352, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.25.1/24, Local: 10.25.1.2, Broadcast: Unspecified,
      Generation: 445
  Protocol iso, MTU: 1500, Generation: 353, Route table: 0
    Flags: Is-Primary
  Protocol inet6, MTU: 1500, Generation: 354, Route table: 0
    Flags: Is-Primary
    Addresses, Flags: Is-Preferred
      Destination: fe80::/64, Local: fe80::2a0:a5ff:fe3d:ac6, Broadcast:
Unspecified,
      Generation: 446
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: feee::10:25:1:0/126, Local: feee::10:25:1:2,
      Broadcast: Unspecified, Generation: 448
```

To view information about the fractional E1 interface, include the `e1-fpc/pic/port` (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces e1-1/2/6 detail
Physical interface: e1-1/2/6, Enabled, Physical link is Up
  Interface index: 89, SNMP ifIndex: 1278, Generation: 341
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: E1, Loopback:None,

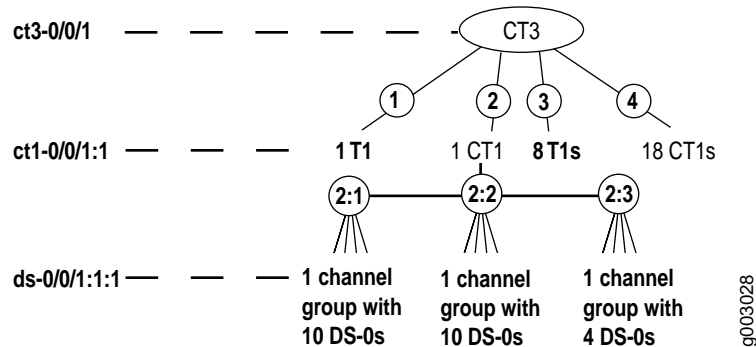
  FCS: 16, Framing: G704, Parent: cel-1/2/6 (Index 25)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 4 (last seen 00:00:05 ago)
    Output: 3 (last sent 00:00:09 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls:
  Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-04 18:28:27 PDT (00:01:07 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :                189                0 bps
    Output bytes  :                478                0 bps
    Input packets :                 13                0 pps
    Output packets:                 28                0 pps
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
    0 best-effort   28                28                0
    1 expedited-fo  0                 0                 0
    2 assured-forw  0                 0                 0
    3 network-cont  0                 0                 0
  DSL alarms      : None
  DSL defects     : None
  DSL BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: Unknown (0)

  Logical interface e1-1/2/6.0 (Index 52) (SNMP ifIndex 1279) (Generation 169)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 1500, Generation: 401, Route table: 0
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.255.126/24, Local: 10.255.126.2, Broadcast: Unspecified,
    Generation: 525

```

## Example: Channelized DS-3 QPP Interface Configuration

Figure 4: Channelized DS-3 QPP Interface Example



This next example shows how to configure a channelized DS-3 QPP interface. Figure 4 shows the breakdown of a DS-3 interface into a variety of channels. The path that leads to  $N \times$ DS-0 channels is similar to the M13 with C-bit parity method seen previously in the complex OC-12 configuration example (see “Example: Complex Configuration for a Channelized OC-12 QPP Interface” on page 14). This method breaks the channelized DS-3 QPP interface into channelized T1s before additional splits create DS-0 timeslots.

To create T1 channels, include the partition statement at the [edit interfaces ct3-*fpc/pic/port*] hierarchy level with the interface-type t1 option. To create channelized T1 channels, include the partition statement at the [edit interfaces ct3-*fpc/pic/port*] hierarchy level with the interface-type ct1 option.

After you have established a channelized T1 channel, you can split it into a maximum of 24  $N \times$ DS-0 channels. To configure  $N \times$ DS-0 channels, include the partition statement at the [edit interfaces ct1-*fpc/pic/port:channel*] hierarchy level with the timeslots and interface-type ds options to create the desired number of  $N \times$ DS-0 channels or channel groups.

Although it is not part of the example below, you can also create a clear channel T3 or a fractional T3 interface on a channelized DS-3 QPP interface. To configure a clear channel T3 or fractional T3 interface, include the no-partition statement at the [edit interfaces ct3-*fpc/pic/port*] hierarchy level. After you commit this part of the configuration, a clear channel T3 interface is established. You can configure standard T3 options on this interface. To fractionalize the T3 interface, include the timeslots statement at the [edit interfaces t3-*fpc/pic/port* t3-options] hierarchy level.

```
Router A [edit]
interfaces {
  ct3-0/0/1 {          #This is the controller level for the entire channelized DS-3 QPP interface.
    partition 1 interface-type t1;    #This creates the t1-0/0/1:1 channel.
    partition 2 interface-type ct1;   #This creates the ct1-0/0/1:2 channel.
    partition 3-10 interface-type t1; #This creates channels t1-0/0/1:3 through t1-0/0/1:10.
    partition 11-28 interface-type ct1; #This creates channels ct1-0/0/1:11 to ct1-0/0/1:28.
  }
}
```

```

t1-0/0/1:1
...
}
ct1-0/0/1:2
  partition 1 timeslots 1-10 interface-type ds; #This is a channel group with 10 NxDS-0s.
  partition 2 timeslots 11-20 interface-type ds; #This is a channel group with 10 NxDS-0s.
  partition 3 timeslots 21-24 interface-type ds; #This is a channel group with 4 NxDS-0s.
}
ds-0/0/1:2:1
  unit 0 {
    family inet {
      address 10.25.1.2/24;
    }
  }
}
ds-0/0/1:2:2
  unit 0 {
    family inet {
      address 10.25.2.2/24;
    }
  }
}
ds-0/0/1:2:3
  unit 0 {
    family inet {
      address 10.25.3.2/24;
    }
  }
}
t1-0/0/1:3
...
}
t1-0/0/1:10
...
}
ct1-0/0/1:11
...
}
ct1-0/0/1:28
...
}
}

```

## Check Your Work

To verify correct operation of a channelized DS-3 QPP interface, use the following commands:

```
show interfaces
```

```
show interfaces controller
```

```
show interfaces interval (for T3, channelized T3, T1, and channelized T1 channels)
```

To view the interface names of the physical channelized DS-3 QPP interface and the channels configured on this interface, use the show interfaces controller command:

```

user@RouterA> show interfaces controller ct3-0/0/1
Controller
ct3-0/0/1
Admin Link
up up

# This is the physical channelized DS-3 (channelized T3) QPP interface.

t1-0/0/1:1
up up

# Channel 1 is a channelized T1 interface.

ct1-0/0/1:2
ds-0/0/1:2:1
ds-0/0/1:2:2
ds-0/0/1:2:3
up up
up up
up up
up up

# Channel 2 is a channelized T1 containing three xxDS-0 interfaces.

t1-0/0/1:3
t1-0/0/1:4
t1-0/0/1:5
t1-0/0/1:6
t1-0/0/1:7
t1-0/0/1:8
t1-0/0/1:9
t1-0/0/1:10
up down
up up
up up
up up
up up
up up
up up
up up

# Channels 3 through 10 are T1 interfaces.

ct1-0/0/1:11
ct1-0/0/1:12
ct1-0/0/1:13
ct1-0/0/1:14
ct1-0/0/1:15
ct1-0/0/1:16
ct1-0/0/1:17
ct1-0/0/1:18
ct1-0/0/1:19
ct1-0/0/1:20
ct1-0/0/1:21
ct1-0/0/1:22
ct1-0/0/1:23
ct1-0/0/1:24
ct1-0/0/1:25
ct1-0/0/1:26
ct1-0/0/1:27
ct1-0/0/1:28
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up
up up

# Channels 11 through 28 are channelized T1 interfaces.

```

To view information about the physical channelized interface, include the `ct3-fpc/pic/port` (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces extensive ct3-0/0/1
Physical interface: ct3-0/0/1, Enabled, Physical link is Up
  Interface index: 30, SNMP ifIndex: 317, Generation: 29
  Link-level type: Controller, MTU: 4474, Clocking: Internal, Speed: T3,
  Loopback: None, FCS: 16, Mode: C/Bit parity, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  Last flapped  : 2002-10-04 10:24:18 PDT (01:40:40 ago)
  Statistics last cleared: 2002-10-04 11:47:27 PDT (00:17:31 ago)
  Traffic statistics:
    Input bytes   :                0          0 bps
    Output bytes  :                0          0 bps
    Input packets :                0          0 pps
    Output packets:                0          0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Bucket drops: 0,
    Policed discards: 0, L3 incompletes: 0, L2 channel errors: 0,
    L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM errors: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
  Active alarms   : None
  Active defects  : None
  DS3 media:
    Seconds      Count  State
    PLL Lock     0       0 OK
    Reframing    0       0 OK
    AIS          0       0 OK
    LOF          0       0 OK
    LOS          0       0 OK
    IDLE         0       0 OK
    YELLOW       0       0 OK
    BPV          0       0
    EXZ          0       0
    LCV          0       0
    PCV          0       0
    CCV          0       0
    LES          0
    PES          0
    PSES         0
    CES          0
    CSES         0
    SEFS         0
  HDLC configuration:
    Policing bucket: Disabled
    Shaping bucket : Disabled
    Giant threshold: 0, Runt threshold: 0
  DSU configuration:
    Compatibility mode: None, Scrambling: Disabled, Subrate: Disabled
    FEAC loopback: Inactive, Response: Disabled, Count: 0
  DS-3 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Algorithm: 2^3 - 1, Pseudorandom (1), Induced error rate: 10e-0
  Packet Forwarding Engine configuration:
    Destination slot: 0 (0x00)
    CoS transmit queue      Bandwidth      Buffer Priority  Limit
                             %      bps      %      bytes
    0 best-effort           95      42499200  95      0      low  none
    3 network-control       5        2236800   5        0      low  none

```

To view information about a channelized T1 channel, include the `ct1-fpc/pic/port:channel` (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces extensive ct1-0/0/1:2
Physical interface: ct1-0/0/1:2, Enabled, Physical link is Up
  Interface index: 175, SNMP ifIndex: 1505, Generation: 174
  Link-level type: Controller, MTU: 1504, Clocking: Internal, Speed: T1,
  Loopback: None, FCS: 16, Framing: ESF, Parent: ct3-0/0/1 (Index 32)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  Last flapped  : 2002-10-04 12:08:23 PDT (00:05:57 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :                0          0 bps
    Output bytes  :                0          0 bps
    Input packets :                0          0 pps
    Output packets:                0          0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
    HS link CRC errors: 0, SRAM errors: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
  DS1 alarms   : None
  DS1 defects  : AIS, LOF
  T1 media:
    Seconds      Count  State
    SEF          0       0 OK
    BEE          1       1 OK
    AIS         355       1 Defect Active
    LOF         355       1 Defect Active
    LOS          0       0 OK
    YELLOW       0       0 OK
    BPV          0       0
    EXZ          0       0
    LCV          0       0
    PCV          0       0
    CS           0       0
    LES         355       0
    ES          355       0
    SES         355       0
    SEFS        355       0
    BES          0       0
    UAS          0       0
  HDLC configuration:
    Policing bucket: Disabled
    Shaping bucket : Disabled
    Giant threshold: 1514, Runt threshold: 0
    Timeslots      : All active
    Line encoding: B8ZS, Byte encoding: Nx64K
    Buildout       : 0 to 132 feet
    Data inversion: Disabled
  DS1 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)
  Packet Forwarding Engine configuration:
    Destination slot: 0 (0x00)
    CoS transmit queue      Bandwidth      Buffer Priority  Limit
                             %      bps      %      bytes
    0 best-effort           95      1459200  95      0      low  none
    3 network-control       5       76800   5       0      low  none

```

To view information about an *NxDS-0* interface, include the *ds-fpc/pic/port:channel* (interface name) option with the `show interfaces` command. In this case, the speed is 640 Kbps because this channel contains 10 DS-Os ( $64 \times 10 = 640$ ).

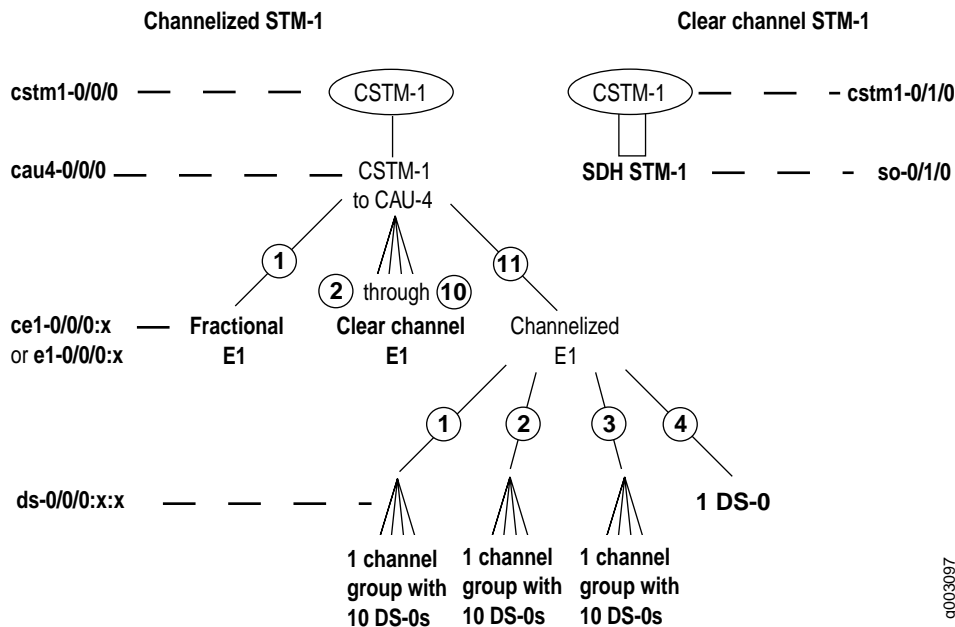
```

user@RouterA> show interfaces extensive ds-0/0/1:2:1
Physical interface: ds-0/0/1:2:1, Enabled, Physical link is Up
  Interface index: 176, SNMP ifIndex: 1563, Generation: 175
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 640kbps,
  Loopback: None, FCS: 16, Parent: ct1-0/0/1:2 (Index 175)
  Device flags      : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags       : Keepalives
  Hold-times       : Up 0 ms, Down 0 ms
  Last flapped    : 2002-10-04 12:09:06 PDT (00:05:54 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes      :                0                0 bps
    Output bytes     :                0                0 bps
    Input packets    :                0                0 pps
    Output packets   :                0                0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
    HS link CRC errors: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
    0 best-effort   0                0                0
    1 expedited-fo 0                0                0
    2 assured-forw 0                0                0
    3 network-cont 0                0                0
  Interface transmit queues:
    B/W  WRR  Packets  Bytes  Drops  Errors
    Queue0  0  0      0      0      0      0
    Queue1  0  0      0      0      0      0
  HDLC configuration:
    Giant threshold: 0, Runt threshold: 0
    Timeslots      : 1-10
    Byte encoding: Nx64K, Data inversion: Disabled
  Packet Forwarding Engine configuration:
    Destination slot: 0, PLP byte: 4 (0x10)
    CoS transmit queue      Bandwidth      Buffer Priority  Limit
                             %      bps      %      bytes
    0 best-effort           95      608000  95      0      low  none
    3 network-control       5       32000   5       0      low  none

```

### Example: Channelized STM-1 QPP Interface Configuration

Figure 5: Channelized STM-1 QPP Interface Example



The next example shows how to configure a channelized STM-1 QPP interface. Figure 5 shows the breakdown of one channelized STM-1 QPP interface into a variety of channels and the conversion of the second interface into a clear channel STM-1.

For the first interface, you must first convert the STM-1 interface into a channelized Administrative Unit 4 (AU-4) interface with the no-partition and interface-type cau-4 statements at the [edit interfaces cstm1-fpc/pic/port] hierarchy level. You must specify KLM or ITU-T AU-4 formatting with the vtmapping statement at the [edit interfaces cau4-fpc/pic/port sonet-options] hierarchy level. From the channelized AU-4 interface, you can create E1 channels or channelized E1 channels. The channelized E1 channels can be further broken into DS-0 timeslots.

To create E1 channels, include the partition statement at the [edit interfaces cau4-fpc/pic/port] hierarchy level with the interface-type e1 option. To create channelized E1 channels, include the partition statement at the [edit interfaces cau4-fpc/pic/port] hierarchy level with the interface-type ce1 option.

After you have established a channelized E1 channel, you can split it into a maximum of 31 NxDS-0 channels. To create the desired number of NxDS-0 channels, include the partition statement with the timeslots and interface-type ds options at the [edit interfaces ce1-fpc/pic/port:channel] hierarchy level. To create an NxDS-0 channel group, include a range of timeslots after the timeslots option.

You can also create fractional E1 interfaces on a channelized STM-1 QPP interface. To configure a fractional E1 interface, include the partition statement at the [edit interfaces cau4-fpc/pic/port] hierarchy level and select the interface-type e1 option. After you commit this part of the configuration, a clear channel E1 interface is established. You can configure standard E1 options on this interface. To fractionalize the E1 interface, include the timeslots statement at the [edit interfaces e1-fpc/pic/port e1-options] hierarchy level. However, timeslot 1 is reserved in a fractional E1 channel, so you can use timeslots 2 through 31.

In the second interface shown in Figure 5 on page 47, you convert the channelized STM-1 QPP interface into a clear channel STM-1 interface. To configure, include no-partition and interface-type so statements at the [edit interfaces cstm1-fpc/pic/port] hierarchy level.

```
[edit]
interfaces {
  cau4-0/0/0 {
    partition 1-10 interface-type e1;#This creates a 10 E1 interfaces: e1-0/0/0:1 through :10.
    partition 11 interface-type ce1;#This creates a single channelized E1 interface:
    sonet-options {
      # e1-0/0/0:11.
      vtmapping itu-t;          #This selects ITU-T as the VT mapping frame format.
    }
  }
  cstm1-0/0/0 {
    no-partition interface-type cau4;#This creates a channelized AU-4 interface: cau4-0/0/0.
  }
  e1-0/0/0:1 {
    #Channel e1-0/0/0:1 is a fractional E1 interface.
    encapsulation ppp;
    e1-options {
      timeslots 2-21;          #Setting timeslots on an E1 channel creates a fractional E1.
    }
    unit 0 {
      family inet {
        address 10.133.0.1/30;
      }
    }
  }
  e1-0/0/0:2 {
    #Channels e1-0/0/0:2 through :10 are standard E1
    interfaces.
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.133.0.5/30;
      }
    }
  }
  ...
  e1-0/0/0:10 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.133.0.37/30;
      }
    }
  }
  ce1-0/0/0:11 {
    #Channel ce1-0/0/0:11 is a channelized E1 interface.
    partition 1 timeslots 1-10 interface-type ds;#This creates channel group ds-0/0/0:11:1.
    partition 2 timeslots 11-20 interface-type ds;#This creates channel group ds-0/0/0:11:2.
    partition 3 timeslots 21-30 interface-type ds;#This creates channel group ds-0/0/0:11:3.
    partition 4 timeslots 31 interface-type ds; #This creates a DS-0 interface: ds-0/0/0:11:4.
  }
}
```

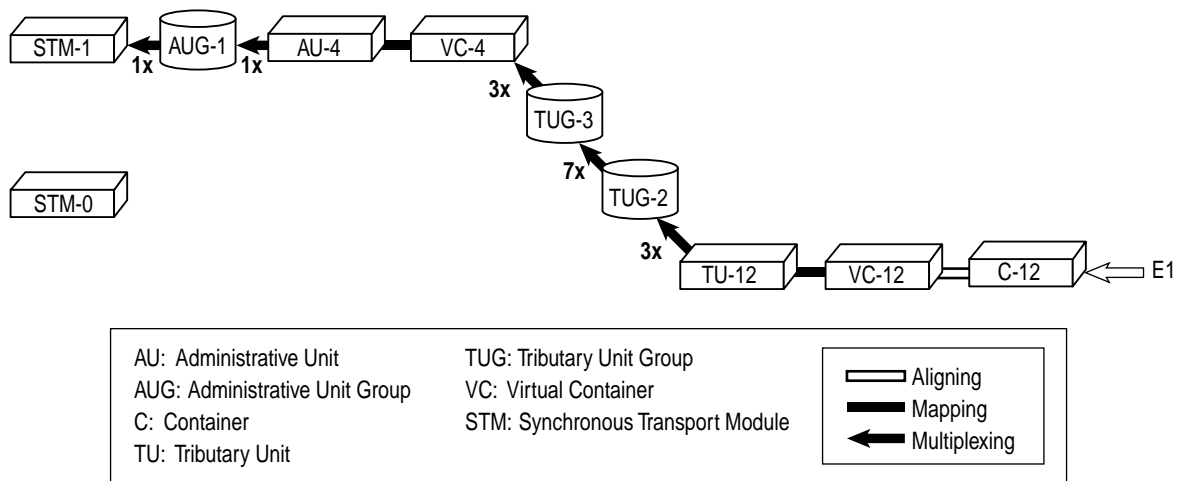
```

ds-0/0/0:11:1 {          #Channel ds-0/0/0:11:1 is a channel group containing 10 DS-0s.
  unit 0 {
    family inet {
      address 10.134.1.1/30;
    }
  }
}
ds-0/0/0:11:2 {          #Channel ds-0/0/0:11:2 is a channel group containing 10 DS-0s.
  unit 0 {
    family inet {
      address 10.134.2.1/30;
    }
  }
}
ds-0/0/0:11:3 {          #Channel ds-0/0/0:11:3 is a channel group containing 10 DS-0s.
  unit 0 {
    family inet {
      address 10.134.3.1/30;
    }
  }
}
ds-0/0/0:11:4 {          #Channel ds-0/0/0:11:4 is a standard DS-0 interface.
  unit 0 {
    family inet {
      address 10.134.4.1/30;
    }
  }
}
}

```

For a visual representation of the E1 to STM-1 SDH mapping method used by Juniper Networks in its channelized STM-1 QPP interface, see Figure 6.

Figure 6: Channelized STM-1 QPP Interface SDH Mapping Method



g003098

## Check Your Work

To verify correct operation of a channelized STM-1 QPP interface, use the following commands:

```
show interfaces
```

```
show interfaces controller
```

```
show interfaces interval (for channelized STM-1, E1, and channelized E1 channels)
```

To view the interface names of the physical channelized STM-1 QPP interface and the channels configured on this interface, use the `show interfaces controller` command:

```
user@router> show interfaces controller cstm1-0/0/0
Controller
cstm1-0/0/0
cau4-0/0/0
  e1-0/0/0:1
  e1-0/0/0:2
  e1-0/0/0:3
  e1-0/0/0:4
  e1-0/0/0:5
  e1-0/0/0:6
  e1-0/0/0:7
  e1-0/0/0:8
  e1-0/0/0:9
  e1-0/0/0:10
  cel-0/0/0:11
    ds-0/0/0:11:1
    ds-0/0/0:11:2
    ds-0/0/0:11:3
    ds-0/0/0:11:4
```

Admin	Link
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up

To view information about the physical channelized interface, include the `cstm1-fpc/pic/port` (interface name) option with the `show interfaces` command:

```
user@router> show interfaces cstm1-0/0/0
Physical interface: cstm1-0/0/0, Enabled, Physical link is Up
  Interface index: 146, SNMP ifIndex: 35
  Link-level type: Controller, Clocking: Internal, SDH mode, Speed: OC3,
Loopback: None, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped   : 2003-02-06 15:01:56 PST (07:15:06 ago)
  SDH alarms    : None
  SDH defects    : None
```

To view information about the channelized AU-4 channel, include the `cau4-fpc/pic/port` (interface name) option with the `show interfaces` command:

```
user@router> show interfaces cau4-0/0/0
Physical interface: cau4-0/0/0, Enabled, Physical link is Up
  Interface index: 147, SNMP ifIndex: 36
  Link-level type: Controller, Clocking: Internal, SDH mode, Speed: OC3,
Loopback: None, Parent: cstml-0/0/0 Interface index 146
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped   : 2003-02-06 19:36:31 PST (02:40:42 ago)
  SDH alarms    : None
  SDH defects   : None
```

To view information about an E1 channel, include the `e1-fpc/pic/port:channel` (interface name) option with the `show interfaces` command. In this case, the fractional E1 appears as channel `e1-0/0/0:1` and the normal E1 appears as channel `e1-0/0/0:2`.

```
user@router> show interfaces e1-0/0/0:1
Physical interface: e1-0/0/0:1, Enabled, Physical link is Up
  Interface index: 148, SNMP ifIndex: 33
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 1280Kbps,
```

# Because the fractional E1 uses 20 timeslots, 20 x 64 Kbps = 1280 Kbps.

```
Loopback: None, FCS: 16, Framing: G704,
  Parent: cau4-0/0/0 Interface index 147
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 1055 (00:00:03 ago), Output: 1059 (00:00:06 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured,
mpls: Not-configured
  CHAP state: Not-configured
  Last flapped   : Never
  Input rate     : 16 bps (0 pps)
  Output rate    : 16 bps (0 pps)
  DS1 alarms    : None
  DS1 defects   : None
  SDH alarms    : None
  SDH defects   : None

Logical interface e1-0/0/0:1.0 (Index 67) (SNMP ifIndex 169)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 1500
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.133.0.0/30, Local: 10.133.0.1
```

```

user@router> show interfaces e1-0/0/0:2
Physical interface: e1-0/0/0:2, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 34
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: E1,
Loopback: None, FCS: 16, Framing: G704,
  Parent: cau4-0/0/0 Interface index 147
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 917 (00:00:05 ago), Output: 915 (00:00:01 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured,
mpls: Not-configured
  CHAP state: Not-configured
  Last flapped   : Never
  Input rate     : 16 bps (0 pps)
  Output rate    : 16 bps (0 pps)
  DS1 alarms    : None
  DS1 defects   : None
  SDH alarms    : None
  SDH defects   : None

Logical interface e1-0/0/0:2.0 (Index 68) (SNMP ifIndex 170)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 1500
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.133.0.4/30, Local: 10.133.0.5

```

To view information about a CE1 channel, include the `ce1-fpc/pic/port:channel` (interface name) option with the `show interfaces` command:

```

user@router> show interfaces ce1-0/0/0:11
Physical interface: ce1-0/0/0:11, Enabled, Physical link is Up
  Interface index: 169, SNMP ifIndex: 288
  Link-level type: Controller, Clocking: Internal, Speed: E1, Loopback: None,
Framing: G704, Parent: cau4-0/0/0 Interface index 147
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped   : 2003-02-06 22:05:23 PST (00:13:45 ago)
  DS1 alarms    : None
  DS1 defects   : None
  SDH alarms    : None
  SDH defects   : None

```

To view information about an *NxDS-0* interface, include the `ds-fpc/pic/port:channel:channel` (interface name) option with the `show interfaces` command. For channel group `ds-0/0/0:11:1`, the speed of the link is 640 Kbps because it contains 10 DS-0s ( $64 \times 10 = 640$ ). For single DS-0 channel `ds-0/0/0:11:4`, the speed of the link is the standard 64 Kbps.

```

user@router> show interfaces ds-0/0/0:11:1
Physical interface: ds-0/0/0:11:1, Enabled, Physical link is Up
  Interface index: 170, SNMP ifIndex: 289
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 640kbps,
Loopback: Illegal, FCS: 16,
  Parent: cel-0/0/0:11 Interface index 169
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 0 (never), Output: 0 (never)
  LCP state: Conf-req-sent
  NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mppls:
Not-configured
  CHAP state: Not-configured
  Last flapped   : Never
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  DS0 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)

Logical interface ds-0/0/0:11:1.0 (Index 77) (SNMP ifIndex 290)
  Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 1500
  Flags: Protocol-Down
  Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
    Destination: 10.134.1.0/30, Local: 10.134.1.1

user@router> show interfaces ds-0/0/0:11:4
Physical interface: ds-0/0/0:11:4, Enabled, Physical link is Up
  Interface index: 173, SNMP ifIndex: 295
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 64kbps, Loopback:
Illegal, FCS: 16,
  Parent: cel-0/0/0:11 Interface index 169
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 0 (never), Output: 0 (never)
  LCP state: Conf-req-sent
  NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mppls:
Not-configured
  CHAP state: Not-configured
  Last flapped   : Never
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  DS0 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)

Logical interface ds-0/0/0:11:4.0 (Index 80) (SNMP ifIndex 296)
  Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 1500
  Flags: Protocol-Down
  Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
    Destination: 10.134.4.0/30, Local: 10.134.4.1

```

## Configure Class of Service for Channelized QPP Interfaces

On channelized QPP interfaces, you can apply class of service at the logical interface level on Frame Relay data-link connection identifiers (DLCIs). To configure class of service schedulers at the DLCI level, see the following:

Configure a Class-of-Service Scheduler Map on page 54

Associate the Scheduler to a DLCI on a Channelized QPP Interface on page 54

Example: DLCI Class of Service on Channelized QPP Interfaces Configuration on page 55

Check Your Work on page 57

### **Configure a Class-of-Service Scheduler Map**

To configure a class-of-service scheduler map, include the scheduler-map statement at the [edit class-of-service interfaces *interface-name* unit *logical-unit-number*] hierarchy level.

To specify the amount of bandwidth allocated to the logical interface, you must also include the bandwidth statement at the [edit class-of-service interfaces *interface-name* unit *logical-unit-number*] hierarchy level. You can specify a peak bandwidth rate in bits per second (bps), either as a complete decimal number or as a decimal number followed by the abbreviation k (1000), m (1,000,000), or g (1,000,000,000). The range is 1000 through 32,000,000,000 bps.

```
[edit]
class-of-service {
  interfaces {
    interface-name {
      unit logical-unit-number {
        scheduler-map map-name;
        bandwidth rate;
      }
    }
  }
}
```

If you do not include the bandwidth statement in the configuration, the logical interface might not be able to transmit traffic unless surplus bandwidth is available on the physical interface. The sum of the bandwidth you allocate to all of the logical interfaces on a physical interface should not exceed the bandwidth of the physical interface.

### **Associate the Scheduler to a DLCI on a Channelized QPP Interface**

For Channelized OC-12 QPP, Channelized DS-3 QPP, Channelized STM-1 QPP, and Channelized E1 QPP with Frame Relay encapsulation, you can associate a scheduler map name with a logical interface. To activate transmission scheduling on a DLCI, include the per-unit-scheduler statement at the [edit interfaces *interface-name*] hierarchy level:

```
[edit]
interfaces {
  interface-name {
    per-unit-scheduler;
  }
}
```

}

For channelized QPP interfaces, the number of schedulers you can apply varies by channel level. Table 5 shows the number of schedulers you can apply at each channel level.

**Table 5: Scheduler Limitations for Channelized QPP Interfaces**

Channelized PICs with QPP	Number of Schedulable DLCIs per level
Channelized OC-12 QPP	63 for T3, OC-3, and OC-12 channels
Channelized DS-3 QPP	63 for T3 channels
Channelized STM-1 QPP	63 for STM-1 channels and 15 for E1 channels
Channelized E1 QPP	15 for E1 channels

You can associate up to 4 forwarding classes per physical interface. You can configure logical interface scheduling on up to 16 physical interfaces per QPP PIC. Keep in mind that you can configure either a physical interface scheduler or a logical interface scheduler, but not both types of scheduler on the same interface simultaneously.

If you use a Gigabit Ethernet QPP interface, you can apply schedulers on up to 768 VLANs per PIC. For more information on class of service for VLANs on a Gigabit Ethernet QPP interface, see the *JUNOS Internet Software Configuration Guide: Network Interfaces and Class of Service*.

### **Example: DLCI Class of Service on Channelized QPP Interfaces Configuration**

This example applies class of service at the logical interface level on a clear channel T3 interface derived from a channelized DS-3 QPP interface (For more information on configuring a channelized DS-3 QPP interface, see “Example: Channelized DS-3 QPP Interface Configuration” on page 41).

Configure a scheduler map, complete with the desired transmit rates, buffer sizes, and service classes. Once the scheduler map is ready, enable logical interface-level class of service with the per-unit-scheduler statement at the [edit interfaces *interface-name*] hierarchy level. Also, configure a DLCI for each logical interface with the dcli *dcli-number* statement at the [edit interfaces *interface-name* unit *unit-number*] hierarchy level. Finally, configure the logical interfaces for class of service with the scheduler-map and bandwidth statements at the [edit class-of-service interfaces *interface-name* unit *unit-number*] hierarchy level. These statements specify the scheduler map to associate with each logical interface and how much bandwidth to reserve for the DLCI queues.

```
[edit]
interfaces {
  ct3-3/1/0 {
    no-partition interface-type t3;#This converts the channelized DS-3 QPP interface to a T3.
  }
  t3-3/1/0 {
    per-unit-scheduler; # This enables scheduling at the logical interface level.
    encapsulation frame-relay;
    unit 0 { # The logical interface where scheduler map sched-0 takes effect.
      dcli 100; # The DLCI affected by scheduler map sched-0.
      family inet {
        address 10.40.1.1/30;
      }
    }
  }
}
```



}

## Check Your Work

To verify correct operation of class-of-service schedulers on a channelized QPP interface, use the following commands:

```
show class-of-service forwarding-table
```

```
show class-of-service interface
```

```
user@juniper> show class-of-service interface t3-3/1/0
Physical interface: t3-3/1/0, Index: 169
Scheduler map: <default>, Index: 1

Logical interface: t3-3/1/0.0, Index: 68
  Object      Name                Type                Index
  Scheduler-map sched-0                11204
  Rewrite     exp-default          exp                 2
  Classifier  ipprec-compatibility ip                   5

Logical interface: t3-3/1/0.1, Index: 69
  Object      Name                Type                Index
  Scheduler-map sched-1                7038
  Rewrite     exp-default          exp                 2
  Classifier  ipprec-compatibility ip                   5
```

## For More Information

For additional information about channelized QPP interfaces (including BERT support, M13 and VT mapping, and other topics) or the original channelized interfaces, see the following:

*JUNOS Internet Software Configuration Guide: Network Interfaces and Class of Service*

*JUNOS Internet Software Configuration Guide: Getting Started*

## Revision History

30 June 2003—Added STM-1 QPP class of service and APS/MSP for OC-12 QPP and STM-1 QPP PICs, 6.0R1 Release. Elizabeth Lichtenberg.

2 April 2003—Added STM-1 QPP PIC and DLCI-level class of service, 5.7R1 Release. Richard Hendricks.

27 December 2002—5.6R1 Release. Richard Hendricks.

11 November 2002—Initial document written. Richard Hendricks.

